electronicsForYou EXPRESS

MARCH 2023

VOL. 3 ISSUE NO. 5 • PAGES: 92

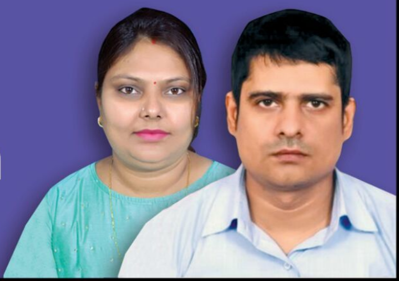
BUDGET 2023: What's Important for Our Industry?

STARTUP #1

India's portable power

STARTUP #2

Dry disinfection



STARTUP #3

A home for veggies

How To Convert ChatGPT Into An Advanced Voice Assistant

Hello
I need help

"We Import Defectives From 50 To 60 Countries, Repair Them And Send Them Out"

—Nikhil Rao, Flex, India

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plus, we publish all the ads from the main magazine along with those booked for XP.

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it's a typical FREEMIUM offering where you get to read our content (some of it) for free, and if you like it and want all of it, you pay for the print or ezine edition of the main magazine.

we publish all ads of the magazine

DOES IT HELP?
oh yes!

we have seen subscriptions of the print and ezine editions go up month-over-month since the launch of XP in Oct 2020.

our overall readership of (selected) editorial and (all) advertisements has doubled.

last 4 editions of XP witnessed average readership crossing 2-plus lakhs on our website alone!

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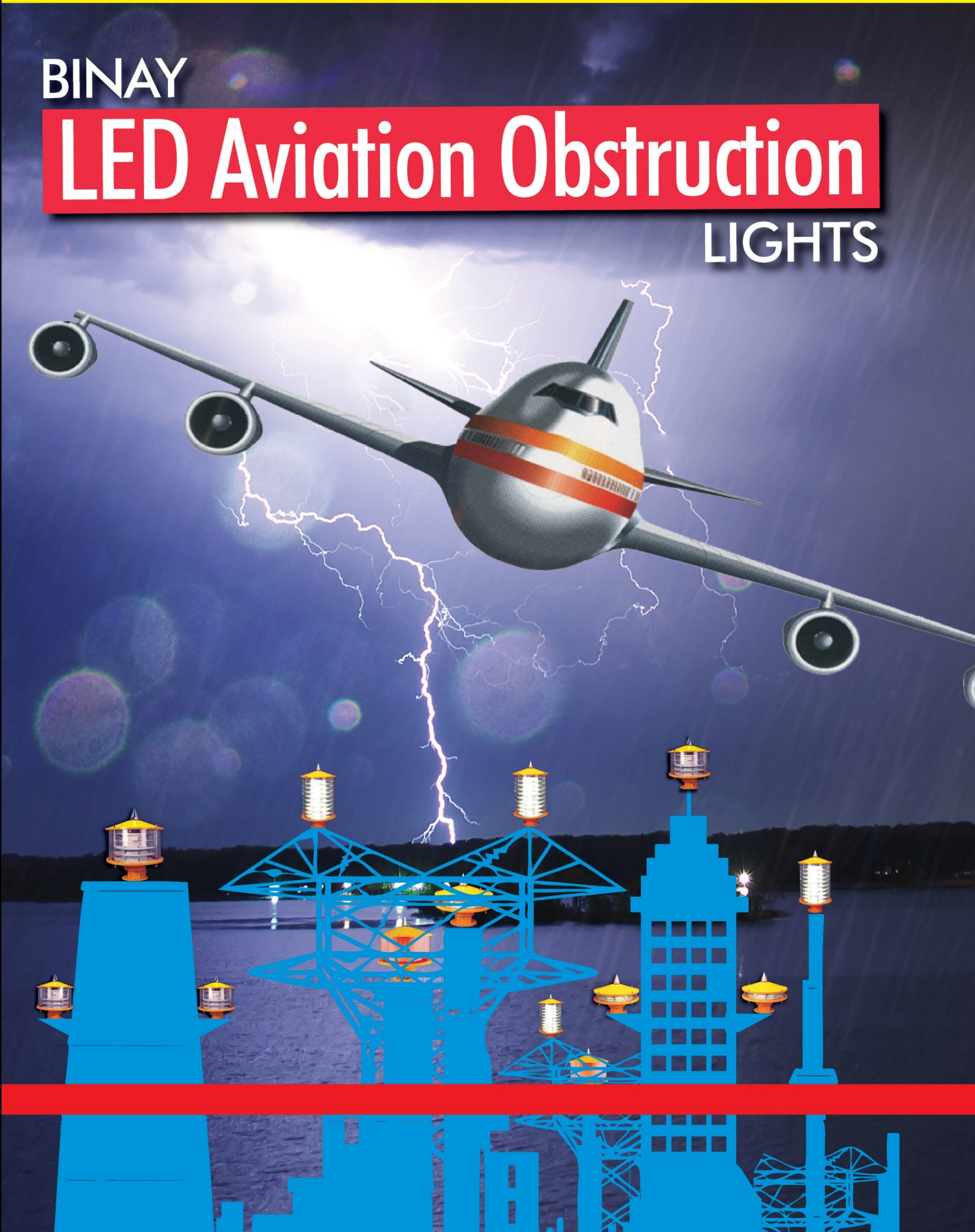
PROVIDING LED POWERED

BINAY
LED Aviation Obstruction
LIGHTS



TECHNOLOGIES SINCE 1983

BINAY LED-based HIGH, MEDIUM and LOW Intensity Aviation Obstruction Light Beacons

As per International Civil Aviation Organisation (ICAO) requirements Available in Low Intensity, Medium Intensity and High Intensity versions (as per International Civil Aviation Organization guidelines), BINAY's patented LED Aviation Lights come with 5-year/3-year warranties

DESIGNED, DEVELOPED, AND MANUFACTURED IN INDIA

High Intensity
200,000 candela
(Flashing White LEDs)

Medium Intensity
20,000 candela
(Flashing White LEDs)

Medium Intensity
2,000 candela
(Flashing Red
OR Fixed Red LEDs)

All BINAY Aviation Lights are based on Non-switching passive type circuitry (NO SMPS)

The circuitry incorporated inside the LED Aviation Obstruction Lights is passive electronic (solid-state) in nature, and does not use internal SMPS driver switching units to control the light unit. Internal LED current control is by non-switching electronic means only. No electrolytic capacitors are used inside the Aviation Obstruction Light unit.

The above is necessary to ensure reliability of the LED Aviation Obstruction Light. This system design effectively eliminates any active components and circuits inside the aviation light itself, and enhances the solid-state passive reliability of the LEDs (mounted in relatively inaccessible locations at the height of tall structures). This drastically reduces the possibility of component failure - and hence possibility of any maintenance requirement – in the LED Aviation Obstruction Lights themselves (which are mounted at extreme heights in the system).

The BINAY LED Aviation Obstruction Light offers the following advantages:

- Fit-and-forget maintenance-free operation
- A long life of 100,000 hours (20 years at 12 hours daily burning)
- Pays for itself within a short period of operation in the form of reduced installation, maintenance and servicing costs
- Quick Installation; Reliable operation 365 days per year
- Shock-proof and vibration-resistant
- Over-Designed Intensity to allow for natural LED intensity degradation over its operating lifetime

LED Obstruction Lighting for:

- Industrial chimneys and smokestacks
- Transmission, microwave and cellular towers
- Radio, TV and similar structural towers
- High-rise buildings and structures
- Airports and airfields

THE BINAY LED OBSTRUCTION LIGHT IS UNDER ACCEPTED PATENT, AND AS SUCH IS A PROPRIETARY PRODUCT

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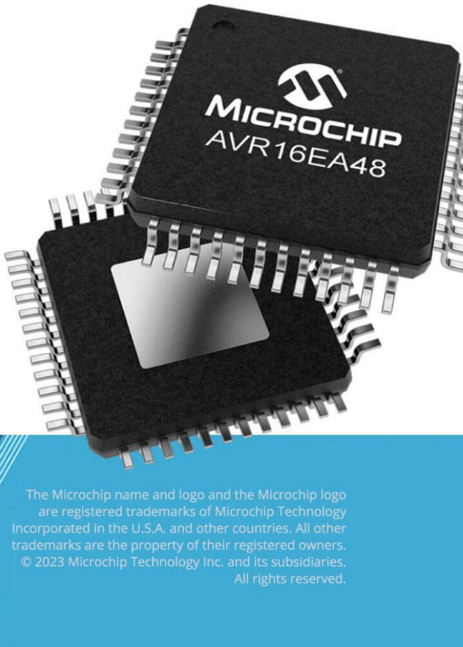

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FROM YOU

YOUR SUGGESTIONS AND THINGS YOU WANTED TO KNOW!

GAS SENSOR

How does an MQ-6 gas sensor work and how can I connect it in the gas leakage project I am working on?

Ankit

EFY. The output voltage of MQ-6 gas sensor varies depending on the concentration of the gas in the air. In general, the output voltage decreases as the concentration of the target gas increases. The sensor's output voltage can be read using an analogue-to-digital converter (ADC) and then processed by a microcontroller to determine the concentration of the target gas.

Fig. 1: MQ-6 gas sensor

The sensor output voltage also varies depending on the temperature and humidity of the environment. So, it is important to calibrate the sensor in the specific environment where it will be used. Also, the sensor should be heated for a few minutes before using it to get an accurate reading. An image of the MQ-6 is shown in Fig. 1.

MQ-6 module has four pins: VCC, GND, AO, and DO. VCC is the positive power supply pin, typically connected to a voltage between 2.5V and 5V. GND is the ground pin, connected to the negative power supply. AO (analogue output) pin gives the sensor's output voltage, which can be read using an ADC. DO (digital output) pin can be used to get a digital output from the sensor.

• • •

APP CREATION

I want to create an app for turning a smartphone into a contactless IR thermometer as my project. Where can I get detailed guidance for app creation, please?

Kamal Avula

EFY. You can make an app using MIT App Inventor or Kodular. The code has .aia file in it. When you import the .aia file in Kodular or MIT App Inventor, you can see how code blocks are attached and coded. Alternatively, you can refer the following link to learn how to make an app easily using code blocks: *http://ai2.appinventor.mit.edu/reference*

• • •

FACE RECOGNITION

Can we use Raspberry Pi 3 instead of Raspberry Pi 4 to make a face recognition robot?

Ehab Pilloor

EFY. Yes, you can use Raspberry Pi 3 in place of Raspberry Pi 4, but the processing will be much slower. For best performance regarding processing the images, use Raspberry Pi 4 with 2GB RAM, but you can experiment with some variations as well.

• • •

TEMPERATURE CONTROL

This is regarding the 'Temperature Controlled Switch' DIY article published in January issue. How should I calibrate LM35 for 60°C instead of 50°C?

Pranjal

EFY. The IC LM35, heart of the circuit, gives variable voltage at the output based on temperature up to 150°C. For every one degree rise in temperature there is 10mV increase in voltage at the output pin. If at 0°C the output of sensor is 0V, when the temperature rises to 10°C the output will become 100mV; at 60°C it will become 600mV.

Calibration of LM35 sensor should be done by heating it. Op-amp LM358 has been used to compare the output voltage of LM35 with the reference voltage. Since you want to calibrate for 60°C, set for threshold voltage of 60°C to trigger the op-amp. You need to set the reference voltage to 0.6V using pot VR1, as at 60°C the output of LM35 will be 0.6V.

As soon as LM35 sensor is heated (up to 60°C), the temperature at pin 3 of IC3 goes higher than the reference voltage at pin 2, so the output of op-amp IC3 at its pin 1 goes high and relay RL1 energises. Your calibration is done.

• • •

SMART WATCH PROJECT

This is regarding the DIY article 'Smart Watch With Fitness Tracking' published in February issue. Is this project open source based?

Mangiferus

EFY. Yes, this project is open source. However open source used in smart watch project is for personal use only as non-commercial activity.

• • •

SMART GLASSES

This is regarding the 'Smart Glasses Like Google Glass Made With OLED Display' article published in November issue. Could you please guide me further on this project as I am very new to Raspberry Pi and programming?

Abhishek

EFY. You can discuss your doubts on *https://www.electronicsforu.com/forums* and learn how to use Raspberry Pi with small projects available on *electronicsforu.com.*

• • •

PCB DESIGN

My teacher has asked me to draw the printed circuit board diagram for my project. Please guide me how I can do so?

Pramod Kumar

EFY. You can design PCBs using software like EasyEDA, Altium, Eagle, Kicad, etc. For the basics, please check *https://www.electronicsforu.com/technology-trends/learn-electronics/printed-circuit-board-pcb-basics*

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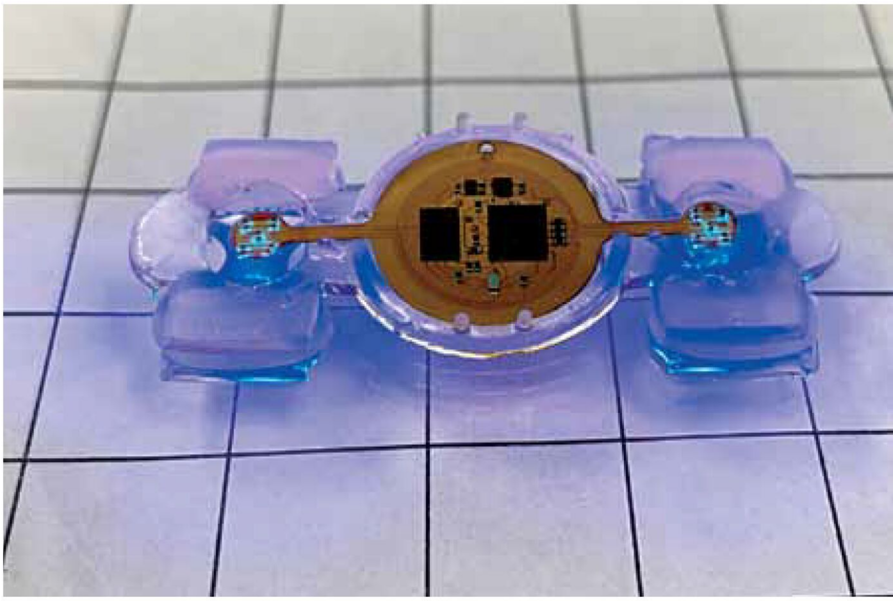
Small biological robots made with living muscle and microelectronics

Researchers at the University of Illinois Urbana-Champaign, Northwestern University and collaborating institutions have developed hybrid "eBiobots" that combine soft material, living muscle, and microelectronics. These small biological robots are powered by mouse muscle tissue grown on a soft 3D-printed polymer skeleton. To enable practical applications of the device, researchers eliminated the use of bulky batteries and tethering wires. The eBiobots use a receiver coil to harvest power and provide a regulated output voltage to power the micro-LEDs. A wireless signal to the eBiobots prompts the LEDs to pulse. The LEDs stimulate the light-sensitive engineered muscle to contract, moving the polymer legs so that the machines "walk." The micro-LEDs are so targeted that they can activate specific portions of muscle, making the eBiobot turn in a desired direction.



Remotely controlled miniature biological robots have many potential applications in medicine, sensing, and environmental monitoring (Credit: https://techxplore.com)

Shape-shifting antenna array takes shapes like curves, saddles, and spheres

Kaushik Sengupta (Credit: Princeton University)

Researchers led by Kaushik Sengupta at Princeton University have developed a new type of shape-shifting array, designed like a folded paper box called a waterbomb, which allows engineers to create a reconfigurable and adaptable radar imaging surface. The system was built by installing a new class of broadband metasurface antennas onto standard, flat panels. They connected a number of the antenna panels into a precisely designed origami surface with an offset checkerboard pattern. Through a proper sequence of folding and unfolding the panels, the array assumes a variety of different shapes like curves, saddles, and spheres. With this ability to shift and expand, the origami system offers a wider resolution and has the ability to capture complex three-dimensional scenes beyond the capability of a standard antenna array.

Artificial neuron that mimics nerve cells can be used for medical treatments

An artificial organic neuron that closely mimics the characteristics of biological nerve cells has been created by researchers at Linköping University (LiU), Sweden. This artificial neuron can stimulate natural nerves, making it a promising technology for various medical treatments in the future. This new artificial nerve cell called "conductance based organic electrochemical neuron" or c-OECN, closely mimics 15 out of the 20 neural features that characterise biological nerve cells, making its functioning much more similar to natural nerve cells. The device uses ions that control the flow of electric current through an n-type conducting polymer, leading to spikes in the device's voltage. The artificial neuron can stimulate the vagus nerve itself and could pave the way for essential applications in various forms of medical treatment.

Padinhare Cholakkal Harikesh, lead author of the new study, makes the chemical transistors used in the artificial neurons (Credit: Thor Balkhed)

A new system barely uses any power for short-range communication

Researchers have developed a communication system that barely uses any power to operate for short-range communication applications. This new system enables wireless transmission of data simply by opening and closing a switch that connects a resistor to an antenna; no need to send power to the antenna. When combined with techniques for harvesting energy from the environment, it could lead to all manner of devices that transmit data, including tiny sensors and implanted medical devices, without needing batteries or other power sources. Apart from the energy needed to flip the switch, no other energy is needed to transmit the information. In our case, the switch is a transistor, an electrically controlled switch with no moving parts that consumes a minuscule amount of power. A switch connects and disconnects a strong electrical signal source—perhaps an oscillator that produces a sine wave fluctuating two billion times per second—to the transmit antenna.

This experimental setup shows an ultra-low-power wireless communications device that could one day be used in tiny remote sensors (Credit: Zerina Kapetanovic, CC BY-ND)

Harvesting electromagnetic energy from moving trains made possible

Researchers from the Virginia Tech Center for Vehicle Systems and Safety (CVeSS) and the Railway Technologies Laboratory have found a way to harvest electromagnetic energy from rail transportations. They have created a new kind of tie that replaces the conventional wooden variety and is equipped to generate power. This tie is placed underneath the rail, topped with a heavy metal bar mounted on a spring. As the wheels of the train pass over the rail, the train's weight pushes down on that bar, triggering a series of gears. Those gears rotate a generator, creating electricity, which can then be stored in a battery. Researchers harvested 15 to 20 watts of power for every wheel of the train passing over the rail.

Yang Chen inspects an energy-harvesting rail in the Railway Technologies Laboratory (Credit: Alex Parrish for Virginia Tech)

A thought-to-text communication system that "speaks" the thoughts

Stanford University researchers have published a paper claiming a record in thought-to-text communication through a brain-computer interface (BCI), with a subject being able to "talk" at a rate of 62 words per minute. Their work consists of "neuroprosthesis"—a brain-computer interface (BCI) that uses intracortical microelectrode arrays to capture high-resolution recordings of its users' brain activity associated with speech. Researchers tested their work on an individual whose illness resulted in an inability to generate intelligible speech. The device enabled the subject to think words and have them decoded at a rate of 62 words per minute, which is over three times faster than previous state-of-the-art BCI speech systems. The device accuracy was measured 9.1% for a limited 50-word vocabulary and increased to 23.8% for 125,000 word-vocabulary, which makes it usable.

New system-on-chip identifies and manages neurological disorders

NeuralTree (Credit: Alain Herzog)

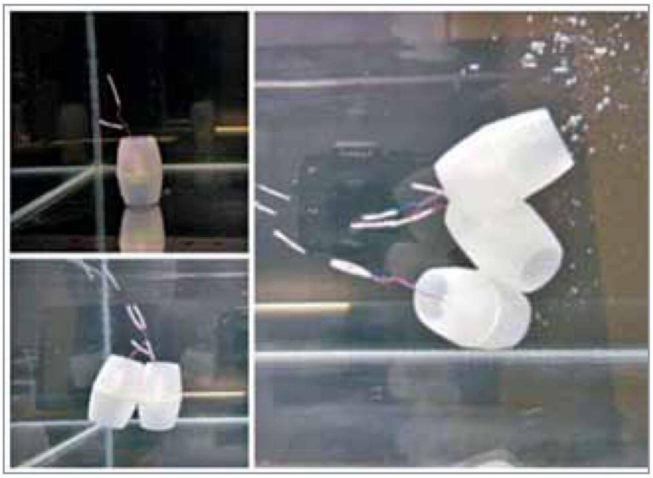
Researchers at Ecole Polytechnique Fédérale de Lausanne have developed a system called NeuralTree to identify and manage neurological disorders with its machine learning ability. NeuralTree is a closed-loop neuromodulation system-on-chip that can detect and alleviate disease symptoms. The system can extract and classify a broad set of biomarkers from real patient data and animal models of disease in-vivo, leading to a high degree of accuracy in symptom prediction. The system consists of a 256-channel high-resolution input sensing array and an energy-efficient machine learning processor. It can detect a broader range of symptoms than other devices, which until now have focused primarily on epileptic seizure detection. The chip's machine learning algorithm was trained on datasets from both epilepsy and Parkinson's disease patients, and accurately classified pre-recorded neural signals from both categories.

Detecting radio signals from distant galaxies made possible

Astronomers from McGill University in Canada and the Indian Institute of Science (IISc) in Bengaluru have used data from the Giant Metrewave Radio Telescope (GMRT) in Pune to detect a radio signal from atomic hydrogen in a distant galaxy at redshift $z = 1.29$. This is the first confirmed detection of strong lensing of 21cm emission from a galaxy. This detection was made possible by a phenomenon called gravitational lensing, in which the light emitted by the source is bent due to the presence of another massive body, such as an early type elliptical galaxy, between the target galaxy and the observer, effectively resulting in the "magnification" of the signal. The atomic hydrogen mass of this particular galaxy is almost twice as high as its stellar mass. Results demonstrate the feasibility of observing atomic gas from galaxies at cosmological distances in similar lensed systems with a modest amount of observing time.

Underwater robots engineered to operate in extra-terrestrial oceans

Scientists at the University of Bristol have drawn on the design and life of a mysterious zooplankton to develop underwater robots. These robotic units called RoboSalps, after their animal namesakes, have been engineered to operate in unknown and extreme environments like extra-terrestrial oceans. RoboSalps have light, tubular bodies and can link to each other to form "colonies" which gives them new capabilities that can only be achieved because they work together. These simple modules can be combined into 'colonies' that are much more robust and have the potential to carry out complex tasks. When swimming on their own, RoboSalps modules are difficult to control, but after joining them together to form colonies, they become more stable and show sophisticated movements. By joining them together, scientists can obtain a redundant system that is robust against any possible failure.


RoboSalps in action (Credit: Valentina Lo Gatto)

New material can easily recover valuable material in Li-ion batteries for reuse

Lawrence Berkeley National Laboratory (Berkeley Lab) scientists have invented a new battery material called the Quick-Release Binder, that makes it simple and affordable to separate the valuable material in Li-ion batteries from the other components and recover them for reuse in a new battery. A battery made with Quick-Release Binder simply needs to be opened, placed in room temperature alkaline water, and gently shaken. The separated elements are easily filtered out of the water and air-dried. Polyacrylic acid (PAA) and polyethylenimine (PEI) are joined through a bond between positively charged nitrogen atoms in PEI and negatively charged oxygen atoms in PAA. When the solid binder material is placed in alkaline water containing sodium hydroxide (Na + OH–), the sodium ion pops into the bond site, breaking the two polymers apart. The separated polymers dissolve into the liquid, freeing any electrode components embedded within.

Chen Fang holds a vial (left) containing a current collector copper foil from a battery that has been completely freed of valuable electrode components after the Quick-Release Binder dissolved, and another vial (right) where the binder is actively dissolving in alkaline water (Credit: Marilyn Sargent/ Berkeley Lab)

Neuro-robotic bionic arm restores natural arm movement

A team of researchers from Cleveland Clinic have now developed a neurorobotic prosthetic arm for patients with upper-limb amputations that allows wearers to think, behave, and function more like a person without an amputation. The investigators developed the bionic prosthetic system to combine three important functions: Intuitive motor control, touch, grip kinesthesia or the intuitive feeling of opening and closing the hand. This bionic system enables wearers to move their prosthetic arm more intuitively and feel sensations of touch and movement at the same time. The closed-loop neural-machine interface connects with the wearer's amputated limb nerves. It enables patients to send nerve impulses from the brain to the prosthetic limb when they wish to use or move it, as well as to receive physical information from the environment and relay it back to the brain through the nervous system.

Brain Machine Interface based prosthetic bionic arm (Credit: Cleveland Clinic)

Japan rolls out 'humble and lovable' delivery robot

Japanese firm ZMP has introduced RokuRO, a four-wheeled robot that walks the streets of Tokyo delivering groceries. Proponents hope that this robot can address the shortage of delivery workers. The robot won't be operating entirely alone, with humans monitoring remotely and able to intervene. The revised traffic laws will allow self-driving delivery robots to navigate streets across Japan. Regulations set a maximum speed of six kilometres per hour (four miles per hour), meaning the chances of severe injury in the event of a collision are relatively small. Panasonic says its "Hakobo" robot can judge autonomously when to turn as well as detect obstacles, such as construction and approaching bikes, and stop. Test runs so far have ranged from delivering medicine and food to Fujisawa residents to peddling snacks in Tokyo with disarming patterns such as: "Another cold day, isn't it? How about some hot drinks?"

A four-wheeled robot dodges pedestrians on a street outside Tokyo, part of an experiment businesses hope will tackle labour shortages and rural isolation (Credit: https://techxplore.com)

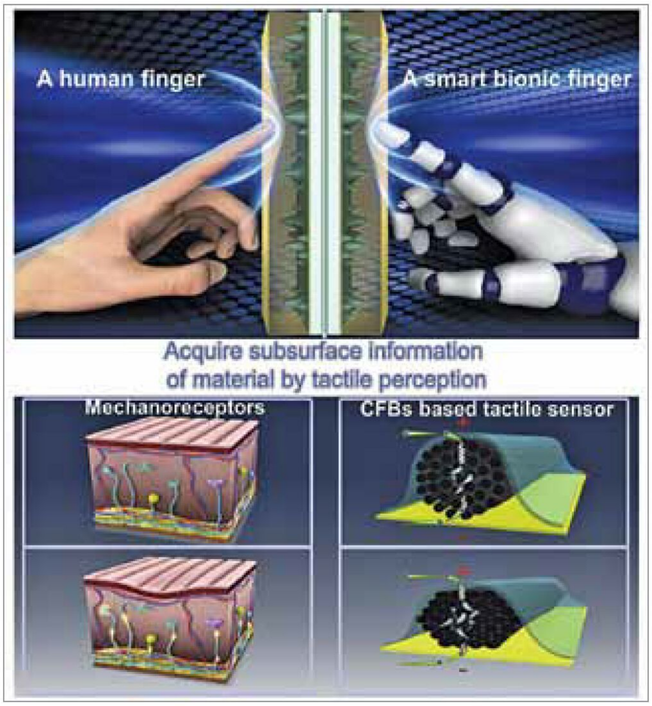
Perovskite windows to reduce energy load in buildings

According to a research effort led by the U.S. Department of Energy's National Renewable Energy Laboratory (NREL), thermochromic windows in office buildings improve energy efficiency across all climate zones in the United States by modulating the temperature inside, leading to a massive savings. Thermochromic windows are based on the use of perovskite materials to absorb energy from the sun shift from transparent to a visibly absorbing or reflecting state. Researchers developed a model in which they built a 12-story structure with a window-to-wall ratio of 95%. They simulated energy use in the building in 15-minute intervals for a year in eight climate zones across the country, covering Hawaii, Arizona, California, Colorado, New York, Wisconsin, Minnesota, and Alaska. They determined that thermochromic double-pane windows improved building energy efficiency over double-pane windows in each zone and energy savings were greater in colder regions as well, as the thermochromic double-pane windows outperformed even triple-pane windows in the hottest climate zones.

Downtown Denver features many buildings with glass facades. Researchers from NREL say retrofitting these windows with thermochromic ones can improve energy efficiency across all climate zones in the US (Credit: Dennis Schroeder, NREL)

Bionic finger creates 3D internal maps of objects by touching their surface

Researchers from Wuyi University have developed a bionic finger that can create 3D maps of the internal shapes and textures of complex objects by touching their exterior surface. The inspiration for this device comes from the human finger with which we can sense not only the texture of our skin but also the outline of the bone beneath it. The bionic finger "scans" an object by moving across it and applying pressure—think of a constant stream of pokes or prods. With each poke, the carbon fibres compress, and the degree to which they compress provides information about the relative stiffness or softness of the object. Depending on the object's material, it might also compress when poked by the bionic finger: rigid objects hold their shape, while soft objects deform when enough pressure is applied. This information, along with the location at which it was recorded, is relayed to a personal computer and displayed on screen as a 3D map.


A human finger
A smart bionic finger
Acquire subsurface information of material by tactile perception
Mechanoreceptors
CFBs based tactile sensor

Graphical abstract (Credit: Cell Reports Physical Science, 2023)

Smart contact lenses that can implement AR based navigation

Researchers from Ulsan National Institute of Science and Technology (UNIST) and KERI have developed core technology for smart contact lenses that can implement augmented reality (AR) based navigation, with a 3D printing process. This technology can realise AR by printing micro-patterns on a lens display using a 3D printer without applying voltage. The key is the meniscus of used ink. The meniscus of the acidic-ferric-ferricyanide ink is formed on the substrate when the ink-filled micronozzle and substrate come in contact. When water evaporates from the meniscus, the water molecules and precursor ions move toward the meniscus surface by convective flow, generating a preferential accumulation of the precursor ions in the outer part of the meniscus. Simply by wearing a lens, navigation unfolds in front of a person's eyes through AR. Games such as the popular "Pokemon Go" can also be enjoyed with smart contact lenses, not just smartphones.

TRULY INNOVATIVE ELECTRONICS

INNOVATION UPDATES

Amongst numerous press releases of new products received by us, these are the ones we found worthy of the title *Truly Innovative Electronics*

Silicon photonics optical gyroscope

ANELLO Photonics SIPHOG is the world's first silicon photonics optical gyroscope. The SIPHOG is a low-noise and low-drift optical gyroscope smart sensor leveraging a photonic integrated circuit (IC) technology. This makes it the smallest optical gyroscope in the world, which enables reliable and accurate navigation and positioning across many autonomous applications. The SIPHOG can enable companies to design more stable, accurate, and robust sensors for various autonomous applications. It also features Anello's Sensor Fusion Engine, which delivers a full end-to-end offering to customers in various fields of autonomy where position, navigation, and timing are essential.

ANELLO
Ethernet
CAN
USB
PWR

ANELLO Photonics
https://www.anellophotonics.com

Multi-function PMIC

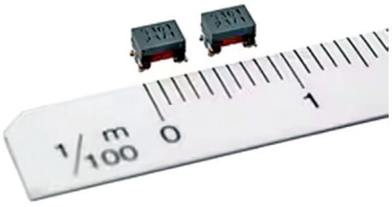
Nordic Semiconductor's nPM1300 is a multi-function power management IC (PMIC) that supports both charging of larger batteries and four regulated power rails. It comes in a small size measuring just 3.1mm × 2.4mm. The nPM1300 features hard reset, battery fuel gauge, system-level watchdog, power loss warning, and recovery from failed boot. It is digitally configurable through an I2C-compatible two-wire interface (TWI). The PMIC also features port detection and automatic current limit up to 1500mA through USB-C power delivery. The nPM1300 PMIC simplifies the work of system designers by integrating longer run time and efficient battery charging and featuring essential functions required for Bluetooth Low Energy embedded designs.

NPM1300
CAAAB0
2302AA

Nordic Semiconductor
https://www.nordicsemi.com

Common mode automotive filter

TDK Corporation ACT1210E series is the industry's first common mode filter for automotive Ethernet 10Base-T1S. The ACT1210E series achieves the industry's best high S-parameters (scattering parameters) and a maximum line-to-line capacitance of 10pF. The operating temperature range is from -40°C to +125°C. Laser welding winding wires to the metalising terminals provides high thermal shock resistance and outstanding reliability. The ACT1210E series is capable of supporting multidrop topologies, which enables multiple ECUs to be connected together. This is essential for upcoming driverless vehicles where number of electronic components and sensors will increase dramatically, and in order to optimise the performance all the ECUs need to work in sync. The ACT1210E series' characteristics are suited to these needs and contribute to improving the quality of telecommunication and suppressing noise in an automotive system.



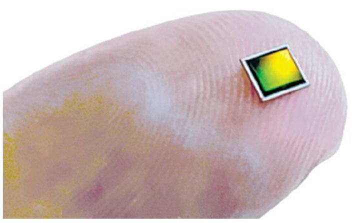
TDK Corporation
https://www.tdk.com

First software vision sensor

The Visual Behaviour has released Aloception, the world's first software vision sensor. Aloception is capable of automatically navigating through crowded areas by detecting obstacles using only a camera. It does the localisation and mapping of the surrounding in real time, which makes it more accurate. It focuses first on the depth and geometric understanding of the environment before the semantic aspect of things. The Aloception can be used for navigation in various applications, such as autonomous vehicles and drones.

Visualbehavir
https://visualbehavior.ai

Image sensor and camera module



Spectricity's S1 is the world's first truly miniaturised mass-manufacturable multispectral image sensor and camera module for mobile devices. The sensor combines spectral and spatial features to increase the accuracy of the camera algorithms, which enable true colours through accurate and advanced white balancing. This allows it to achieve stable performance under uncontrolled and complex user environments. The sensor features the fuse spectral images and RGB images to create rich data in dynamic environments and enable advanced computer vision applications. The S1 sensor comes with applicable and optimised optics, a simple interface, a cross-platform API, and the required software stack to yield accurate spectral images. This allows quick integration of the sensor to any application. The sensor will allow designers to display accurate colours in any lighting condition, which was not possible with most existing sensors.

Spectricity
https://spectricity.com

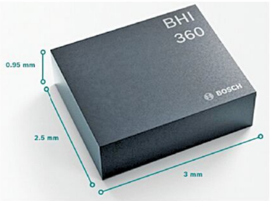
NFC wireless charging IC

PTX30W by Panthronics is the industry's first integrated, single-chip solution for the listener circuit in NFC wireless charging systems. It can operate in standalone mode without an external microcontroller to run NFC wireless charging operations. It combines an efficient rectifier, NFC tag, battery charger and power management, as well as protocol handling. The NFC tag supports bidirectional data communication in NFC Type A mode. This enables the transfer of data between the charging cradle and the charged device, such as the battery's state of charge or fault indicators, as well as enabling firmware upgrades of both devices. The PTX30W will enable designers to build small battery-powered products to implement NFC wireless charging with a board which is around four times smaller than existing designs, thus reducing the size of the product and simplifying the designing process.

Panthronics
https://www.panthronics.com

Programmable smart sensor

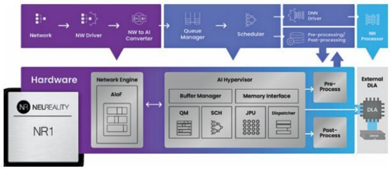
BHI360 from Bosch is the smartest programmable inertial measurement unit (IMU) sensor available in the market today. BHI360 combines a programmable IMU based sensor system that combines a gyroscope with an accelerometer that allows for full customisation. The IMU comes in a small package measuring just 3mm × 2.5mm. The integrated sensor fusion library enables 3D audio with head orientation for personalised sound experiences as well as simple gesture recognition. It consists of an ultra-low-power microprocessor, including pre-installed sensor fusion software and algorithms in a single package. It can be used in wearables and hearables, smartphones and tablets, smart devices, etc.



BOSH
https://www.bosch-sensortec.com

Network attached processing unit

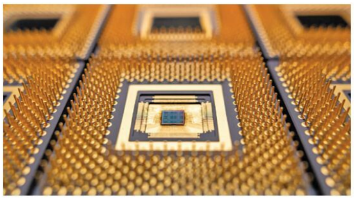
NeuReality NR1 is the world's first network attached processing unit (NAPU)—an inference server-on-a-chip with an embedded neural network engine. It is workflow-optimised hardware with specialised processing units, native network capabilities, and virtualisation capabilities. The NAPU can work with any trained model in any development environment. Its architecture enables inference through hardware with AI-over-fabric, an AI-hypervisor, and AI-pipeline offload. The NR1 will help scientists and engineers to run any AI model faster and easier while reducing the cost.



NeuReality
https://www.neureality.ai

High-efficiency AI chipset

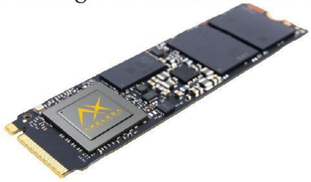
EnCharge's new computing platform can achieve 150 TOPS/W. This enables the processor to run larger AI models with higher accuracy, better resolution, and process data from multiple camera channels simultaneously. The test chip can achieve about 20x higher performance per watt with 14x higher performance per dollar relative to comparable AI accelerators, thus offering revolutionary gains, without time-consuming, cost-prohibitive workarounds. The new computing platform utilises a technique called in-memory computing. The new design can store data and run computation all in the same place on the chip. The EnCharge chipset will thus drastically reduce cost, time, and energy consumption in AI computations.



EnCharge AI
https://enchargeai.com/technology

AI edge accelerator module

Axelera AI M.2 is an AI edge accelerator module that is powered by a single Metis AI processing unit (AIPU). It delivers up to 214 tera-operations per second (TOPS) while minimising power consumption and simplifying integration through the downloadable software stack. The Axelera AI M.2 can provide a significant boost to any vision processing system with next generation form factor (NGFF) M.2 socket. It is a high-performance, cost effective, and user-friendly platform combining hardware and software to accelerate computer vision at the edge. The module provides high processing at a fraction of cost and power consumption of alternative solutions available in the market. It will enable engineers to develop smaller and cost-effective products for computer vision applications.



Axelera AI
https://www.axelera.ai

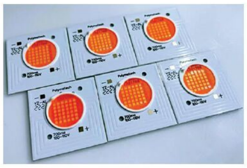
NEW PRODUCTS

MAKE IN INDIA

COMPONENTS

LEDs to improve farming

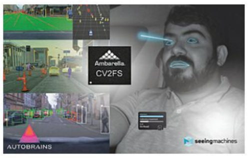
Polymatech Electronics has released Ravaye, a series of LEDs for smart horticulture. The monochromatic LEDs can enhance greenhouse and vertical farming lighting for professional horticulture applications. The LEDs produce a range of wavelengths that can promote healthier plant growth by accelerating photosynthesis, strengthening plant immunity, and increasing nutritional value. The Ravaye LEDs offer a wide variety of wavelength combinations to suit different plant needs. Their light can enhance plant growth, improve farming environments, and can also help lower a farmer's lighting system costs, thus increasing profitability for the farmers.



Polymatech Electronics
www.polymatech.in

SoC with ADAS and DMS

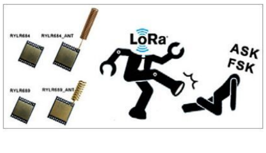
This system-on-chip (SoC) combines advanced driver assistance systems (ADAS) with driver and occupant monitoring. The SoC won't only reduce the size of the component but will also lower the cost, complexity, and speed of adding advanced safety systems to a broad range of vehicles. This integrated solution will require low power consumption, reducing thermal-management needs, which is critical for electric vehicles. The low power and high performance capability enable cameras to be packaged in a single box that can be placed in high-temperature areas, thus giving freedom to designers to place the system anywhere in the vehicle. This allows designers to preserve their development investments while tailoring the selected SoC's processing power to the needs of each car model's features, from basic ADAS and driver monitoring system (DMS) to full domain control using the 5nm CV3 family for Level 2+ to L4 autonomy and beyond.



Seeing Machine, https://seeingmachines.com
Autobrain, https://www.autobrains.ai
Ambarella, https://www.ambarella.com

Long-range transceiver modules

The RYLR684 and RYLR689 from Reyax Technology are cost-effective LoRa and (G)FSK (Gaussian frequency-shift keying) transceiver modules that are suitable for long-range wireless applications. The cost-effective LoRa modules are based on a Semtech LLCC68 chip and have a programmable transmission power level from -20dBm to 22dBm. This allows the designers to optimise the range and power of the transmitter for each use case, thus reducing the energy consumption of battery-powered devices. This replaces the traditional frequency shift keying (FSK) and amplitude shift keying (ASK) that had higher energy consumption. To enhance the sensitivity and achieve better performance, both the modules come with metal covering that protects them against EMI interference, and offer considerably better performance even when surrounded by noise from other devices. The LoRa modules are suitable for a wide range of use cases, including asset tracking, smart agriculture, smart buildings, industrial automation, and various other IoT applications.



Reyax
https://reyax.com

Timekeeper for aerospace and defense

SiT7910 from SiTime Corporation is a 32kHz MEMS Super-TCXO, a timekeeping component used in electronics. The SiT7910 is part of the SiTime Endura ruggedised family for aerospace and defence applications. The Super-TCXO offers up to 25x higher precision, which enables the devices that use GPS signals such as ruggedised handheld radios, ground vehicles, and sensors to lock to GPS more quickly and securely. The SiT7910 measures just 2.5mm × 2.0mm and works with a voltage from 1.62V to 3.63V. It offers a high 20ppb/g g-sensitivity for resilience in high-vibration environments. Moreover, it has ultra-low power consumption, typically 6.0µA, for use in portable aerospace and defense electronics. The Super-TCXO has been designed for long lasting usage and hence it has a ±5ppm frequency aging over 20 years, so the device can maintain its performance for over a decade.

SiTime Corporation
www.sitime.com

Gate driver IC for EV inverters

The RAJ2930004AGM from Renesas is a gate driver IC for driving EV invert-

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ers. It is capable of driving both IGBTs and SiC MOSFETs and has a built-in 3.75kVrms isolator, which is higher than the 2.5kVrms isolator in the previous generation products. The IC boasts superior common mode transient immunity at 150V/ns or higher, providing reliable communication and increased noise immunity while meeting the high voltages and fast switching speeds required in inverter systems. It can support power devices with a withstand voltage of up to 1200V, which makes it suitable to employ in cost-effective inverter systems. The gate driver MOSFET comes in a compact SOIC16 package. The IC offers multiple protection and fault detection functions, such as the on-chip active Miller clamp, soft turn-off, overcurrent (DESAT) protection, under-voltage lockout (UVLO), and fault feedback. The Renesas MOSFET driver can help increase EV adoption by allowing engineers to build cost-efficient inverters, thereby minimising environmental impacts.

Renesas
https://www.renesas.com

Radiation-tolerant LDO

MIC69303RT is Microchip's first commercial-off-the-shelf radiation-tolerant 3A low-dropout (LDO) voltage regulator that is suitable for objects in low-earth orbit (LEO). Operating from a single low-voltage supply of 1.65 to 5.5 volts, the device can supply output voltages as low as 0.5V at high currents, offering high precision and ultra-low dropout voltages of 500mV under extreme conditions. The MIC69303RT is a companion power source solution for Microchip's radiation-tolerant space-qualified microcontrollers, such as the SAM71Q21RT and PolarFire FPGAs, including the RTPF500TLS. Designed for harsh aerospace applications, the MIC69303RT is operational in temperature ranges from -55 to +125°C. It is offered in 8-pin and 10-pin packages with radiation tolerance up to 50Krad. The low noise of the output is critical to sensitive RF circuits, post regulation of switching power supplies, and industrial power applications.

Microchip
https://www.microchip.com

Image sensor for smartphones

OV50H is a 50MP image sensor from Omnivision that supports 12.5MP at 120 frames per second (fps) and high dynamic range (HDR) at 60fps. The image sensor will enable an average user to take noise-free, high-quality pictures even in low-light environments.

The OV50H is a 1.2-micron pixel image sensor in an 8.4mm optical format. The larger sensor size enables it to capture sharp images and allows for faster autofocusing capability even in dark environments. The image sensor supports multiple HDR modes and high frame rates for smartphone rear-facing cameras. It is Omnivision's first sensor to feature horizontal/vertical quad-phase detection, which enables users to capture stable images of fast-moving objects. It offers flagship-level low-light and autofocus performance, supports 12.5MP at 120fps and HDR at 60fps. The sensor can perform 4 cell binning, thus enabling a 12.5MP mode for video and preview with 2.4µm equivalent sensitivity for excellent low-light performance. Moreover, it supports up to 120fps with 4x low-light sensitivity and 8K video with on-chip remosaic. The sensor offers full 50MP Bayer output and 2x crop zoom functionality.

Omnivision
https://www.ovt.com

Gaming processor for smartphones

MediaTek's new Helio G36 processor will enable smartphone manufacturers to provide high-end smartphone specifications at an affordable price. The processor will satisfy the growing demand for low-cost gaming smartphones in India. It offers a better camera, enhanced battery life, and greater processing speed at an affordable cost. Helio G36 will enable the integration of better image sensors, which will allow for high-quality depth of field, and its higher processing power will allow the manufacturers to add their own AI camera features, such as AI beautification and enhanced precision. Helio G36 can run a 90Hz display and offer support for up to 50MP camera. It is built on a highly power-efficient TSMC 12nm production process, which ensures that the phone remains cool for an extended period. MediaTek has

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For details **www.efy.in/elcina-imrb**

electronics
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designed the processor to level up the entry gaming smartphones. It offers global dual 4G connectivity with intelligent connectivity technologies that will improve the network coverage of the smartphone.

MediaTek
https://www.mediatek.com

DIN rail terminal blocks

CUI Devices has released the TBDR family of terminal blocks to its existing line of DIN rail terminal blocks. The TBDR family offers push-in spring or end-cap connector types with feed through or ground type styles. These DIN rail terminal blocks are available in single-level or dual-level packages with 2, 3, or 4 position options, making them suitable for a range of DIN rail mount applications. The TBDR models accept wire sizes of 1.5 or 2.5sqmm, or gauges from 26AWG to 12 AWG, and come in black or gray colours. These terminal blocks carry UL current ratings of 15 or 20A and IEC current ratings from 16 to 24A as well as UL voltage ratings of 300 or 600V DC and IEC voltage ratings of 500 or 800V DC. All models support operating temperature ranges from -40 to 105°C.

CUI Devices
https://www.cuidevices.com

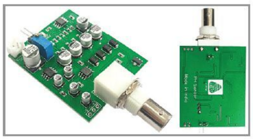
BOARDS AND MODULES

Workstation motherboards

ASUS has released a couple of Intel W790 workstation motherboards—the Pro WS W790E-SAGE SE and the Pro WS W790-ACE. Both the motherboards are built for the latest Intel Xeon W-3400 and W-2400 processors and are capable of handling full overclocking capability of the new processors. The Pro WS W790 series offers comprehensive hardware and software-level remote management to keep IT on track. The Pro WS W790E-SAGE SE uses a dedicated gigabit Ethernet controller assigned to the onboard AST2600 BMC for the connection of IPMI architecture, allowing for BIOS updates, hardware resets, or critical issue fixes via a web UI. Both the motherboards are suitable to meet the high demand of graphic designers, data scientists, architects, engineers, etc and can also be used for application in complex designs, simulations, rendering, and AI inferencing workloads.

ASUS
https://www.asus.com

pH sensor module



Rajguru Electronics has released the ADIY pH sensor module, a sensor for measuring the potential of hydrogen (pH) in any liquid. The low-cost sensor can precisely measure the hydrogen-ion activity in water based solutions. It offers better accuracy than pH indicator solutions and litmus tests. The sensor can easily be integrated with Raspberry Pi and Arduino. It has a measuring range from 0-14pH and offers a resolution of ±0.15pH at standard temperature and pressure. The module utilises hydrogen-ion activity, also known as the "proton activity" for measuring pH of the liquid. This kit's drive board works with 9V systems, making it compatible with many MCUs, including the Arduino and Raspberry Pi. The pH sensor can be used in a variety of pH measurements with fast response and excellent thermal stability. It has good reproducibility and can eliminate basic alkali errors. In the 0pH to 14pH range, the output voltage is linear. The ADIY pH sensor module is suitable for use in applications where acidity and alkalinity testing is required.

Rajguru Electronics
www.rajguruelectronics.com

High-density DC-DC module

The PKB5213D from Flex Power Modules is a new introduction to company's existing PKB-D series of isolated eighth-brick DC-DC converters. The PKB5213D is a high-density DC-DC converter suitable for harsh environments. The power module works with a wide input voltage from 18-60V and provides a fully regulated 12V output delivering power up to 240W. The PKB5213D has high efficiency and can work at high temperatures. The isolated converter module saves the output loads from any fault occurring at the input side, making it suitable for sensitive appliances and use in automotive, medical, and industrial applications. The PKB5213D has high efficiency and can work at high temperatures.

Flex Power Modules
https://flexpowermodules.com

Programmable power supply

Advanced Energy has released an UltraVolt AEQ series of power supply that is suitable for a wide range of medical, life science, industrial, and semiconductor equipment applications. The power supply can deliver up to 600V DC at 0.5W output power from an input voltage of +5V DC. The programmable supply offers a stable output voltage and enhanced isolation support and is suitable for critical high-voltage applications in medical and industrial sectors. A programmable power supply can be adjusted to provide a specific voltage and current output. The output can be programmed and controlled through software or other digital means, allowing for precise control and automation of the power supply in various applications. This type of power supply is commonly used in electronic test and

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measurements, research and development, and manufacturing processes. The precise and stable output voltage, small size and enhanced isolation of the UltraVolt AEQ series makes it suitable for use in high-voltage needs for medical, life science, industrial, and semiconductor applications.

Advanced Energy
https://www.advancedenergy.com

TEST & MEASUREMENT

Handheld spectrum analyser

Field Master MS2070A from Anritsu Company is a rugged battery-powered handheld spectrum analyser. It conducts reliable and accurate RF measurements in a variety of general-purpose field, lab, and manufacturing environments. It has a dynamic range of >105dB at 2.4GHz, typical DANL with a built-in optional preamplifier of -167dBm, coupled with a Third Order Intercept of +11dBm and typical level accuracy of ±0.5dB, which enable a full range of signals to be analysed by the spectrum analyser. The MS2070A is designed for standard swept spectrum analysis up to 3GHz. It features sweep speeds of up to 32GHz/s in common low noise configurations. A number of “smart” measurements, including occupied bandwidth, channel power, and adjacent channel power are standard in the Field Master MS2070A. As many as six traces can be set simultaneously with different detectors. For long-term spectrum monitoring applications, the MS2070A has upper/lower, envelope, and alarm limits standard. The spectrum analyser is suitable for use in harsh environment.

Anritsu
https://www.anritsu.com/en-IN

EMBEDDED

Energy harvesting sensor

SMK’s Gen 2 SCPS is a Bluetooth based ambient sensor with energy harvesting capabilities. The Gen 2 SCPS sensor can collect ambient information, such as temperature, humidity, luminance, CO_2, air pressure, accelerometer, and ambient sound. Its harvesting capability can allow for a battery-free operation of low-powered electronics. The energy harvesting capability and multi-sensing capability in a single package will enable the engineers to develop a lightweight, compact, and no-maintenance sensor node or other IoT devices that can communicate using Bluetooth. Energy harvesting sensors have the advantage of being self-sufficient and not requiring an external power source. This eliminates the need for batteries or external power supplies, which can save cost and maintenance, as well as increase the reliability and lifespan of the sensor. Additionally, energy harvesting sensors can be used in remote or inaccessible locations where power sources are not available.

SMK
https://www.smkusa.com

Universal housing for PCBs/SBCs

Pheonix’s UCS series of housings offer an adjustable and universal solution to accommodate PCBs or single-board computers (SBCs). The IP40 housings can reliably protect PCBs in a standard form factor and custom-designed PCBs from external influences. They can reduce the required space and can be easily mounted on DIN rail or wall. Moreover, the housings can also be used as a desktop with the help of few accessories, thus offering flexibility in the mounting style. The company offers various versions, including one with a flexible PCB attachment, or with a fixed PCB attachment that is integrated into the corner dome. The removable side panels enable a modular electronic solution, which can be cut according to the requirement of the connection technology to be used. There is a stronger version made out of aluminium for higher strength, suitable for harsh industrial environments.

Pheonix Contact
https://www.phoenixcontact.com

Low-power embedded system

Variscite has released the VAR-SOM-AM62, a module for low-power embedded systems. The SoM is powered by the Texas Instruments AM62x, a low-cost MPU with scalable Arm Cortex-A53 performance and embedded features. The VAR-SOM-AM62 runs on 1.4GHz Quad-core Cortex-A53 with 400MHz Cortex-M4F and additional 333MHz PRU real-time co-processors. It offers camera interface MIPI-CSI2, integrated 3D GPU along with dual LVDS display. The VAR-SOM-AM62 is a low-cost device starting from only $33, making it suitable for low-cost embedded industrial products that require high performance and low power. The SoM offers multiple connectivity features, including a certified dual-band Wi-Fi, BT/BLE 5.2, 3x CAN bus, dual USB, and dual GbE. Moreover, it supports industrial operating temperatures. The SoM is a member of Variscite’s Pin2Pin product family, allowing developers to use the same carrier board design for a wide range of processors.

Variscite
https://www.variscite.com

MISCELLANEOUS

DSP IP for in-car entertainment

Cadence Design Systems has released a digital signal processor (DSP) IP in Cadence Tensilica HiFi DSP IP. It is the first DSP IP supporting Dolby Atmos for car. The Dolby Atmos can enhance the immersive sound experi-

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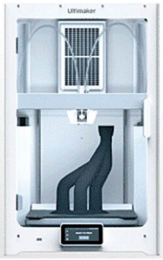
ence for in-car entertainment systems while reducing energy consumption. The Dolby Atmos can also provide the sound signature and playback quality as intended by the music artist. It offers greater audio details, clarity, and sound separation, thus improving the overall music experience.

The Tensilica processor cores can be integrated into SoC designs to provide specialised processing capabilities. The software development tools include compilers, debuggers, and others that enable developers to efficiently create and optimise software for the Tensilica cores.

Cadence
https://www.cadence.com

3D printer with air manager

The UltiMaker S7 is a new and advanced 3D printer from Ultimaker. It is an upgrade over the company's best-selling series of 'S' 3D printers. It features a new flexible build plate that makes removing the printed parts easier. Moreover, it comes with an integrated air manager that filters out up to 95% of ultrafine particles and improves temperature regulation, thus enhancing the quality of printed parts.



The S7 also features an improved automated bed levelling that improves the first-layer adhesion, making it possible to print bigger designs with a smaller base. Advances in temperature regulation on the S7 allow users to capitalize on the large 330mm × 240mm × 300mm build volume—with reliable accuracy from the first printed layer to the last. The flexplate also provides easy part removal post-printing, reducing labour, so users can get on with other tasks. The Ultimaker S7 Pro can hold up to 6 different spools of filaments, enabling it to print multi-colour objects.

UltiMaker
https://ultimaker.com

Cavity pump for adhesives

LiquidFlow 2 from Meter Mix is a cavity pump system for extremely fine dispensing of adhesives and potting compounds. It can be configured for either manual or robotic applications with a wide range of viscosities. The cavity pump can dispense very small and precise amounts of potting compounds, which can reduce wastage and improve the efficiency of the application process. Unlike many other cavity pumps, the LiquidFlow2 operates without pulsation, which enables it to apply very small beads and shots continuously and precisely. The compact metering and mixing system are configured for either manual or robotic application of two-component polyurethane, epoxy resin, silicone, and methacrylate. The LiquidFlow 2 is configured with twin progressive cavity pumps, which can be manufactured from different materials. It offers a high level of flexibility and allows user to store up to 50 different mixing ratios, flow rates, and shot quantities that can be stored via a recipe function. It also features an in-built anti-gel purge timer that prevents the material on the tip from curing in the disposable mixer nozzle.

Meter Mix Systems
https://www.meter-mix.com

MCU edge-AI developer cloud

STMicroelectronics has unveiled the world's first MCU edge-AI developer cloud. The STM32Cube.AI developer cloud opens access to an extensive suite of online development tools built around the STM32 family of MCUs. The STM32Cube.AI desktop front-end includes the resources for developers to validate and generate optimised STM32 AI libraries from trained neural networks. This online tool offers interface to generate optimised C-code for STM32 microcontrollers, without requiring prior software installation. This new tool brings the possibility to remotely benchmark models on STM32 hardware through the cloud to save on workload and cost. The tool can be used for various use cases, including human motion sensing for activity recognition and tracking, computer vision for image classification or object detection, audio event detection for audio classification, etc.

STM32
Cube.AI

STMicroelectronics
https://www.st.com

Operating system for smart card

Infineon Technologies and TrustSEC have jointly developed BIO-SLCOS, an advanced operating system (OS) for smart cards. The OS employs Infineon's new high-performance SLC38 Secure Element to provide a secured and open platform that integrates security, flexibility, and hardware independence to achieve ease of use, performance, and security requirements of the global smart card market. The BIO-SLCOS can support contact, contactless, dual, and USB interfaces. Moreover, it can be preloaded or programmed with fixed applications or enable application uploading after using the card manager module. The solution is suitable for use in government identification, payment, ticketing, and access applications, as well as for application providers looking to enhance their biometric solution in terms of security, performance, and functionality.

Infineon Technologies
https://www.infineon.com

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Unleashing The Power Of Robotics With RobotCore FRAMEWORK

There has not been a better time to supercharge your robots. Meet RobotCore framework, a new open architecture for hardware acceleration in ROS2 to assist you with that. This article describes the powerful capabilities of RobotCore framework and how it can take your robots to the next level

Why ROS?

The Robot Operating System is the de facto framework for robot application development. It is a toolset to build and manage robots through libraries for robotics debugging and visualization utilities, orchestration tools and communication piping

"Nearly 55% of total commercial robots shipped in 2024 will have at least one ROS package installed, creating a large installed base of ROS-enabled robots." Source.

ROS is inherently CPU-centric. There's an opportunity to build custom compute architectures for robots and make them faster with hardware acceleration. Most ROS packages are subject to hardware acceleration and licensed for commercial re-use..

ROS
2
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GAURAV VIKHE is Chief of Product, Acceleration Robotics

The RobotCore framework helps in leveraging hardware acceleration and building custom compute architectures for robots, or IP cores, which make the robots faster, more deterministic, and/or power efficient. RobotCore is a robot-specific processing unit that helps map Robot Operating System (ROS) computational graphs to its CPUs, GPU, and FPGA efficiently to get the best performance. The RobotCore framework is intended to be a modular and extendable framework.

Before moving forward, let us be clear about hardware acceleration. Hardware acceleration is the process of offloading certain computational task to specialised hardware so that you can perform those tasks more efficiently. For example, let us say you are using a simulation software

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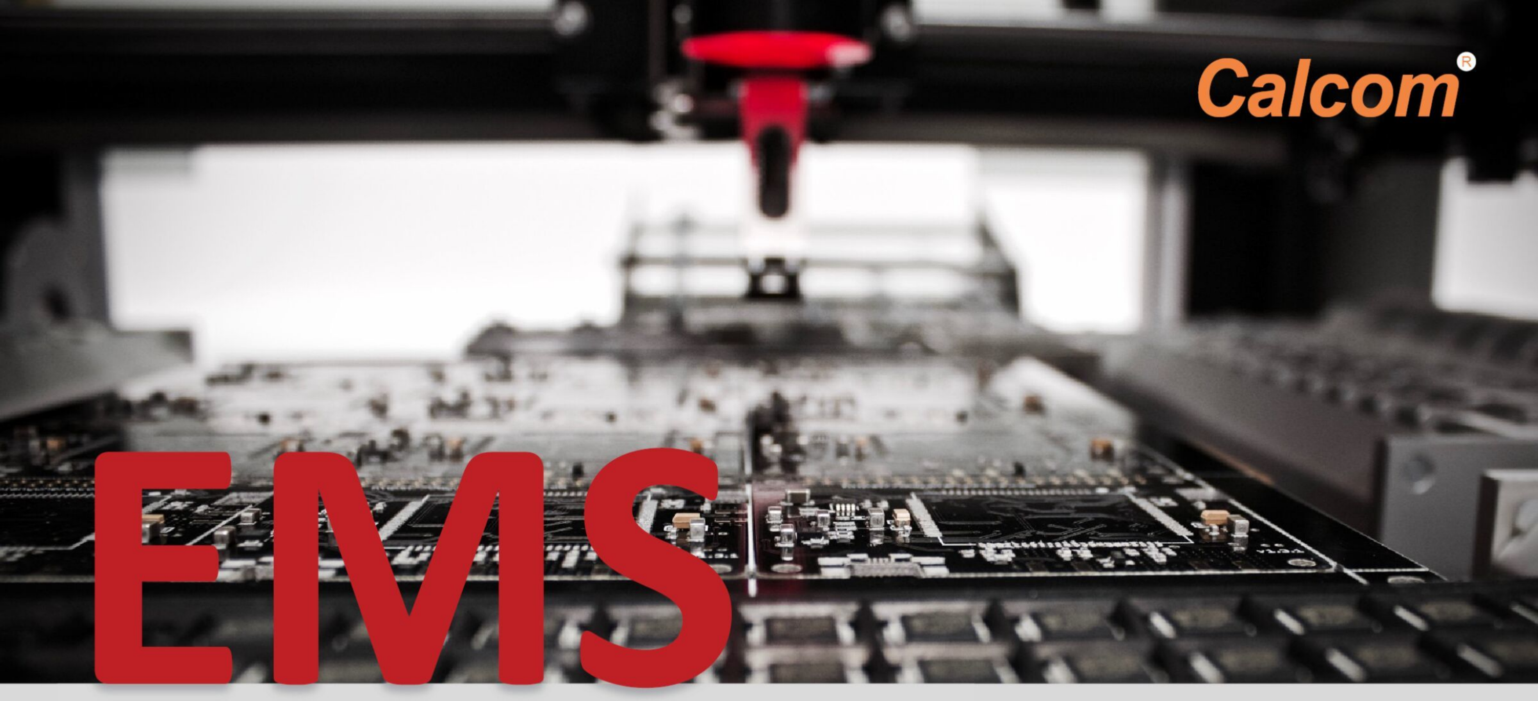

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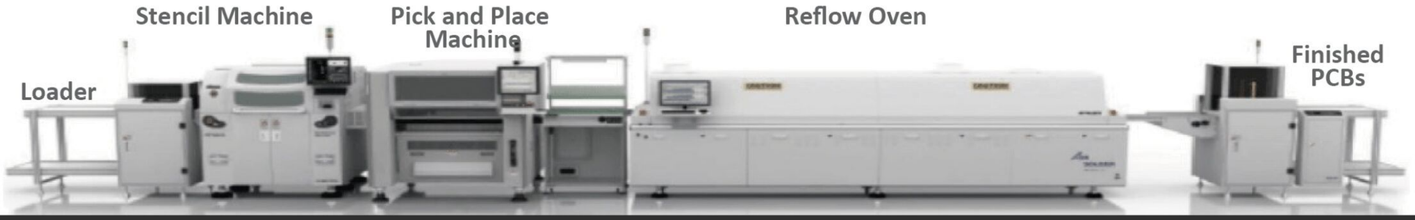

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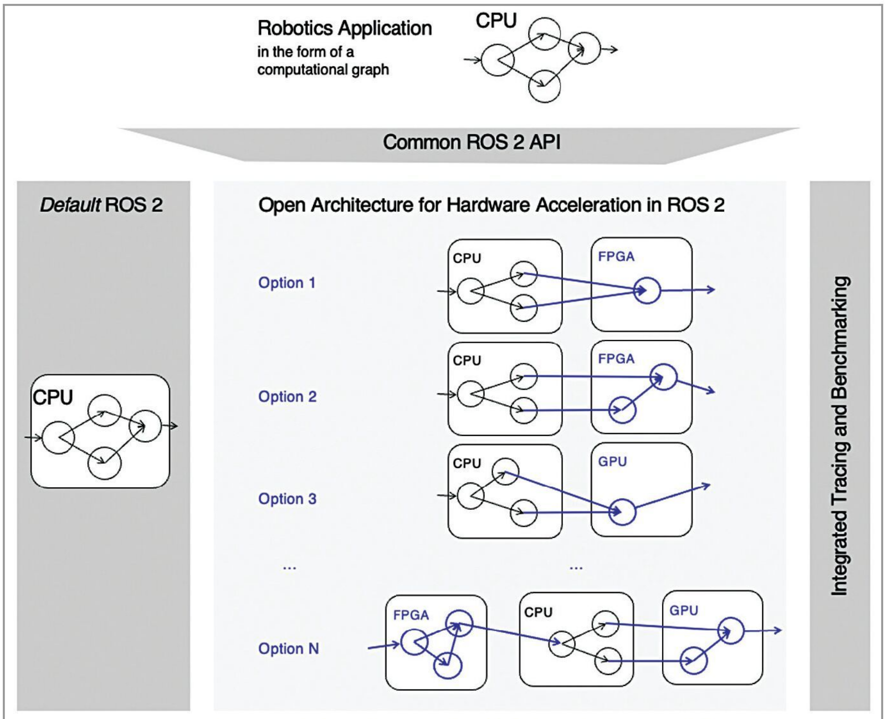
or playing a game, then you would want graphical processing units (GPUs) in your system that could handle the render with ease.

That is what GPU-enabled hardware acceleration is when it comes to simulation software and games. In the context of robotics, hardware acceleration can help you create faster and more power-efficient robots. This is done through various accelerator platforms.

Let us now understand how hardware acceleration is used in robotics. We all have seen the Atlas robot by Boston dynamics. The Atlas uses hardware acceleration in the perception stack to navigate through the obstacles. It uses a time of flight sensor at high frequency to detect and extract surfaces from the environment and then use the navigation stack to navigate and control stack to move through the environment.



https://arxiv.org/pdf/2205.03929.pdf

Fig. 1: Hardware acceleration framework for ROS

It is important to know that all of this has to happen at the edge as you cannot have these computations in the cloud, because the environment is dynamic and constantly changing. The obstacle here is that you cannot afford the latency that cloud computations would have.

This is where the edge devices and special hardware acceleration come in because edge devices by themselves are not fast enough to deal with this situation. That is where you put the hardware accelerator into the mix and get optimal performance.

Let us first look at the compute architectures and how they are used in the robotics context. We can do this by taking the analogy of a factory. A CPU can be thought of as a very generalised workshop where you have very general tools available and you can create anything you want from it. The only bottleneck is that any sort of computation happens sequentially and not parallelly. You can build anything but it just takes some time because things happen sequentially.

Then we have the GPUs, which are basically a very streamlined form of a workshop where there are a lot of workers available but the workers can do only certain tasks. They have a very limited number of tools available to them. GPUs can perform tasks which have a lot of data to deal with parallelly.

From a software engineering perspective, the CPU deals with data points while the GPU deals with data vectors. Therefore, they can parallelly process a lot of computations together. Now, the problem with this is that GPUs require a hardware system expert to develop the architecture to decide what sort of tools are available to an individual worker. That drives up the cost of a GPU. Also, it is not power efficient.

Field programmable gate arrays (FPGAs) are basically factories which can be transformed to do a specific task. Through programs like OpenCL, you can re-configure your factory and produce a specific factory for the product you want to design. The benefit of FPGAs is that they consume low power and give high performance. If you look at the current literature in robotics perception then you will see that FPGAs outperform GPUs in many tasks.

We also have application-specific integrated circuits (ASICs), which are very powerful as well as performance efficient. The problem is that they require high level of hardware expertise and the architectures that are available for ASIC are few

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ROS2 perception graph

RobotCore perception is an optimised robotic perception stack built with RobotCore framework that leverages hardware acceleration to provide a speedup in your perception computations. API-compatible with ROS2 perception stack, RobotCore perception delivers high performance, real-time, and reliability to your robots' perception.

in number. Another problem with ASIC adaptation in robotics is that all of the subfields of robotics like localisation, perception, and control are currently the fields of active research, hence, it lacks a final architecture. Therefore, using ASICs becomes a problem because they have a very specific architecture that needs to be defined. They are also really expensive to develop, so currently it is not really worth the effort.

The Robot Operating System (ROS) is the de facto framework for robot application development. It is a toolset to build and manage robots through libraries for robotics debugging and visualisation utilities, orchestration tools, and communication piping. Nearly 55% of total commercial robots shipped in 2024 will have at least one ROS package installed, creating a large installed base of ROS-enabled robots.

ROS is inherently CPU-centric. There's an opportunity to build custom compute architectures for robots and make them faster with hardware acceleration. Most ROS packages are subject to hardware acceleration and licensed for commercial use.

RobotCore framework: an open architecture for hardware acceleration in ROS2

RobotCore provides a development, build, and deployment experience for creating robot hardware and hardware acceleration kernels similar to the standard, non-accelerated ROS development flow. In the standard data flow of a ROS2 application, passing it through a RobotCore framework leaves you with two benefits. At the node level you get acceleration and you also get inter-process acceleration.

RobotCore framework targets three different verticals in the customer market. First being the development packages for robotics, second being package maintenance, and third is semiconductor manufactures. The robotics division of the semiconductor companies would want to follow the RobotCore framework as it has a huge community acceptance. Semiconductor companies would also benefit as they will be able to get their products to market quicker. Currently, FPGA GPUs are very hot in the robotics market and that is where silicon vendors could benefit tremendously with this framework.

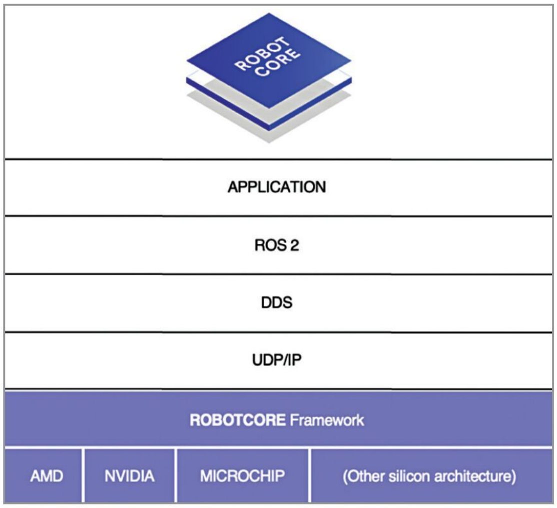

Fig. 2: ROS2 hardware acceleration architecture and convention

One key thing that has been done to get more acceptance of hardware acceleration in the robotics community is to create a hardware acceleration working group as well. This includes accelerator vendors such as AMD Xilink, NVIDIA, and Analog devices.

From RobotCore framework to an open standard

All the silicon vendors like AMD, NVIDIA, and Microchip form the bottom layer as they enable users to use their chips. Above that lies the RobotCore framework where we basically create the build tools to quickly be accepted into the ROS layer. On top of this layer sits the UDP/IP layer, which essentially is the middleware framework for ROS itself. At the top sits the application itself (see Fig. 2). RobotCore framework enables the bottom two layers so that it becomes easy for roboticists to develop applications.

Benchmarking performance in ROS2

The purpose of open-sourcing the RobotCore framework is to enable competition in the market itself as silicon vendors would therefore develop chips that eventually help the roboticists to make better robots. We are also enabling this through a benchmarking effort. We perform tests on FPGA brought to us by silicon vendors themselves.

RobotCore framework is a new open architecture for hardware acceleration in ROS2 that promises to revolutionise the world of robotics. This innovative technology allows developers to build high-performance robots with faster and more efficient processing, paving the way for advanced robotics applications. With the RobotCore framework, the future of robotics is looking brighter than ever. EFY

This article is based on a tech talk at India Electronics Week 2022 by Gaurav Vikhe, Chief of Product, Acceleration Robotics. It has been transcribed and curated by Laveesh Kocher, a tech enthusiast at EFY with a knack for open source exploration and research

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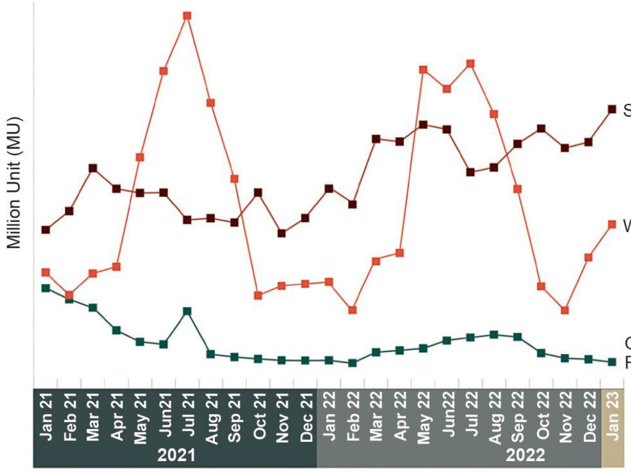
THE DASHBOARD

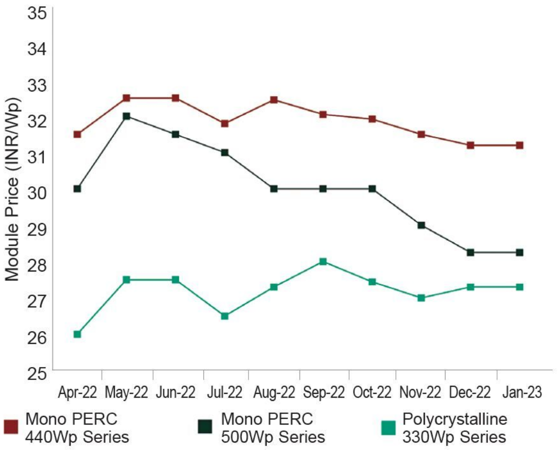
January 2023: Solar Energy Generation Up by 13% in India

JMK Research's monthly report for January noted that the total energy generated from renewable sources stood at 14,413.2MU in January 2023, up by 15.5% from December 2022. Solar and wind energy generation increased by 13.3% and 25.3% respectively on a month-on-month basis in January. The report further pointed out that 14 new renewable energy (RE) tenders with a cumulative capacity of 7,966MW were issued recently. As per JMK's price survey with domestic suppliers for January 2023, the all-inclusive domestic module prices till the project site (including freight charges, GST etc) for mono PERC 440Wp, mono PERC 500Wp, and Polycrystalline 330Wp modules have remained the same in January 2023.

Source-wise Renewable Energy Generation



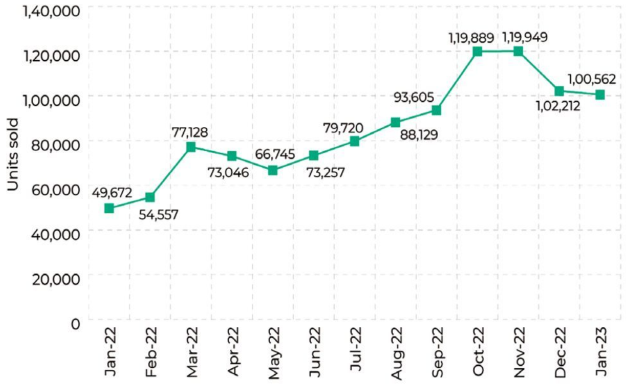
Domestic Module Pricing



(Source: JMK Research)

January 2023: EV Sales Doubles YoY in India; Falls MoM

As per the latest report by JMK Research, the overall EV sales in January 2023 saw a year-on-year (YoY) hike of around 100% from that of EV sales in January 2022. On the downside, though, January sales saw a month-on-month (MoM) decline of ~1.6% to reach 100,562 units. The report noted that EV registrations this month were driven by electric two-wheelers and passenger-type electric three-wheelers, which together accounted for 93.40% of total registrations in January. The shares of these categories were followed by e-cars (3.30%) and cargo-type electric three-wheelers (3.17%).



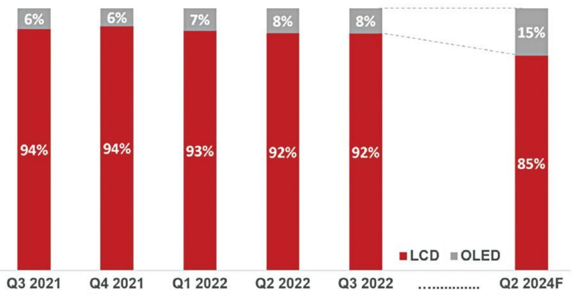
Note: Sales figures represent EVs registered across 1,342 RTOs in 34 states/UTs

(Source: JMK Research)

Pandemic Boosted OLED Tablet Penetration: Report

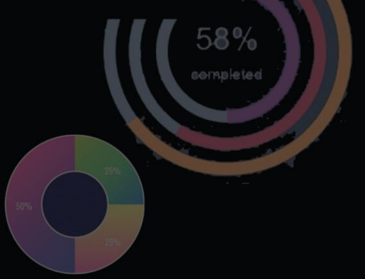
As per Counterpoint's global tablet market tracker, the Covid-19 pandemic has marked a major shift in tablet displays, with OLEDs (organic light emitting diodes) coming under focus. It noted that with the start of the Covid-19 pandemic, the importance of multimedia has increased globally and tablet displays have progressively gained prominence. Though still predominantly consisting of LCD panels, the market has begun to show signs of the increased adoption of OLED in the tablet industry. Unlike the mass adoption of OLED panels that have happened in other devices, the use of OLED in tablets has only been pursued by a handful of OEMs so far. Interestingly, many OEMs have started using OLED display panels in their newest high-end devices. The report suggests that the upcoming technologies and down-spiralling costs of manufacturing are expected to further popularise OLEDs.

Global Tablet Market Share by Display Type



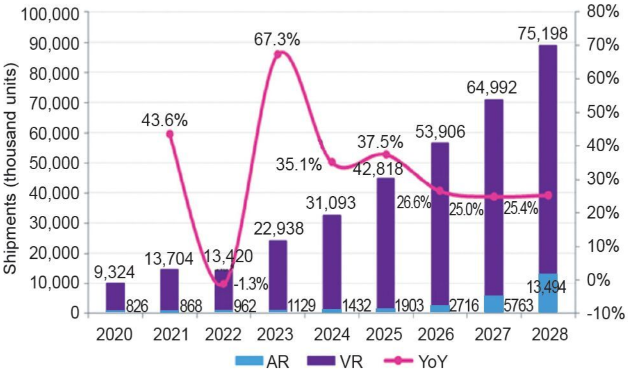
(Source: Counterpoint Research)

At-a-glance view of key industry trends that can shape the future of your business…



Near-Eye Display Shipments for XR Applications Set to Grow

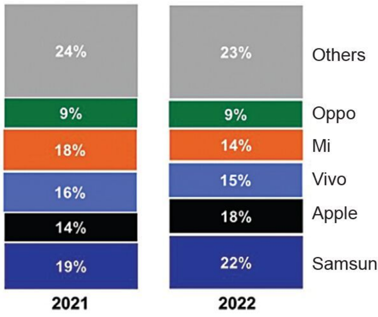
As per the latest research by Omdia, the total shipments of near-eye displays for XR applications, including AR, VR, and MR are expected to be 24 million in 2023 with a 67% YoY growth rate. The report states that in terms of revenues, the near-eye display for XR application revenues touched $620 million in 2022. This year, it expects the near-eye display for the XR application to cross the $1 billion revenue mark for the first time ever, by increasing to $1.15 billion. The report notes that displays for VR applications still form the bulk of shipments. Omdia believes that the maturity of AR display technology would still need three to five years for development, given the complexity of AR displays and optical engines.



(Source: https://omdia.tech.informa.com)

India 2022: Premium Segment Share Up by 11%; Overall Fall in Smartphone Shipments

As per the latest report by Counterpoint, smartphone shipments in India declined 9% YoY to cross 152 million units in 2022. The yearly decline is the second-ever in the Indian smartphone market history. The fall was led by a significant decline in entry-level and budget segments which faced supply constraints at the beginning of the year and then witnessed lower demand throughout the year, the research points out. However, on the upside, 2022 proved to be a good year for premium smartphone sales in India as the segment contributed 11% to India's smartphone shipments and 35% to market revenue in 2022, the highest ever. It is reported that despite a 9% YoY decline in shipments, India's smartphone market revenue remained flat overall. In terms of shipment value, Samsung stood first with a 22% share in 2022. Apple closely followed with an 18% share.

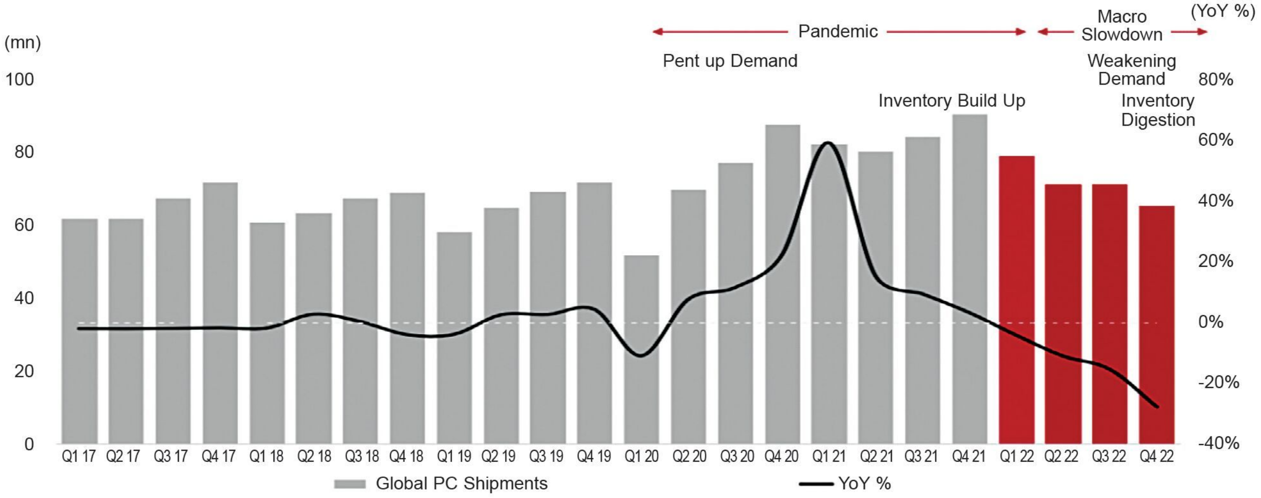


Note: Xiaomi includes POCO; OPPO excludes OnePlus; Vivo includes IQOO; Figures not exact due to rounding

(Source: Counterpoint Research)

4Q 22: Global PC Market Sees Record YoY Downfall

According to Counterpoint, global PC shipments witnessed a record-high year-on-year (YoY) drop in Q4 of 2022. The shipments declined by 27.8% to reach 65.2 million units in the quarter. The PC market, suffering from macroeconomic headwinds, increasing inflation pressure and frozen demand last year, dropped by 15% YoY in 2022. The research observed that although inventory levels of several OEMs and ODMs likely peaked in Q3 2022, the year-end season failed to accelerate the PC shipment momentum in Q4. Counterpoint reports that at 286 million units, the total PC shipments for 2022 also reflect a muted global PC demand with four consecutive quarters of YoY shipment declines. Going by the reported trends, a decent rebound might be too much to ask for before the second half of this year.



(Source: Counterpoint Research)

SANCTUM FOR ESDM TECH: INCUBATION CENTRE IIT PATNA

Hands that help are holier than lips that pray. The Incubation Centre IIT Patna is aiding and harbouring small entrepreneurs with a vision and ideas to come up with feasible solutions for common problems

Portable Power Technology team

The electronics system design and manufacturing (ESDM) industry is touted to be the world's fastest-growing industry, with India committing to raise production to $300 billion by 2025-26. A major chunk of this growth rests on the development and encouragement of new and emerging technologies introduced by startups and entrepreneurs.

To reach this target, the Ministry of Electronics and Information Technology (MeitY) has set up incubation centres in different parts of the country to aid and encourage startup growth. One such incubator, nestled in the sprawling campus of IIT Patna, is the Incubation Centre IIT Patna, commonly known as IC IITP.

In 2014, MeitY approved a project to promote innovation and entrepreneurship in the ESDM industry with a special focus on medical electronics at a total estimated cost of ₹471 million, including a grant-in-aid of ₹221 million from MeitY. The state government of Bihar has agreed to contribute ₹250 million to the project.

The incubation facility aims to incubate 50 startups over five years. The incubation centre offers seed funding of up to one million rupees for each project, along with mentorship, and helps the startups get connected with potential investors. The centre has processed more than 1,000 applications since its inception and has worked with more than 60 startups in medical electronics, healthcare, IoT, automation, robotics, waste management, industrial solutions, consumer electronics, and education.

Out of the many startups under its wing, Electronics For You got in touch with three innovative startups that have managed to set a benchmark in the ESDM sector with IIT Patna's support.

INDIA'S PORTABLE POWER

With the rising demand for lithium-ion batteries, the greener alternative to the conventional lead-acid battery, a new problem of thermal runaway arose. While countries and big manufacturers around the world are racing to come up with an effective solution to make an efficient battery management system, Portable Power Technology Pvt Ltd has come up with India's first indigenously designed battery management system for lithium-ion batteries.

Founded by Abhijeet Kumar, the product that is available in differ-

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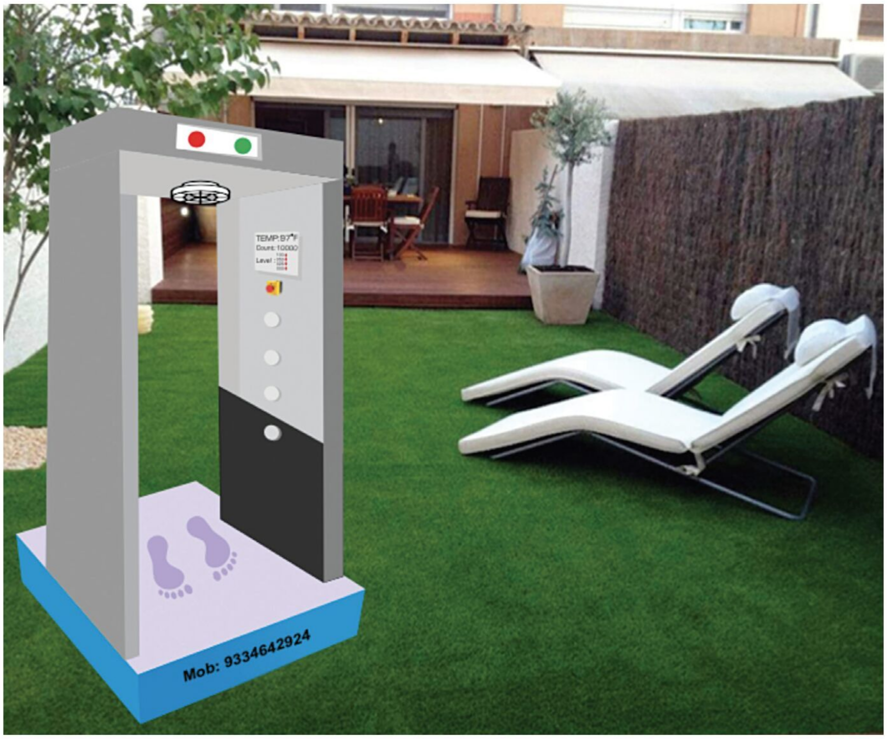
Abhijeet Kumar, Founder

Abhinav, Founder

ent categories has been designed in such a way as to prevent thermal runaway, hence preventing any chance of a fire. The company's custom-designed BMS on a PCB can be used for any electric two-wheeler, three-wheeler, or four-wheeler, or even a single solar cell or an entire solar panel.

The company has designed ten different BMS systems for different types of lithium-ion batteries, ranging from lithium iron phosphate to lithium cobalt oxide. The company takes pride in being able to customise its battery management system as per a customer's voltage and current requirements.



Body Disinfectant Machine

The company has secured a patent for their innovation. Commenting on the achievement, Founder Abhijeet Kumar says, "For every BMS to function properly, we need to control the temperature, voltage, and current. In addition to that we need to optimise the losses in the current and voltage rating. That is where we are different. Our sleeping current is very less. In ideal conditions, our sleeping current is less than 6µA."

Incubated at IIT Patna, the founding team got together in August 2018 to build a lithium-ion battery and BMS specifically for defence applications. Supported by DRDO and IIT Kanpur, who are among its customers, the company is set to commercialise the product from March 2023.

DRY DISINFECTION

The Covid-19 pandemic exposed us to the lax healthcare system in our country. While our doctors and nurses broke their backs trying to save lives, many Covid warriors lost their lives after coming in contact with the disease due to a lack of proper protection kits.

Amid these happenings, a young couple with no technical background, but a will to save lives, started Kingshahi Innovations Pvt Ltd. Startup entrepreneurs, Barun Shahi and his wife Meenakshi Kumari, have come up with a full-body disinfectant machine to completely disinfect any human in hospitals.

As the name suggests, the machine automatically deploys a disinfectant solution in the form of micro-droplets of the size of 50µm when its electronics sensors detect the presence of an adult human being, weighing not more than 125kg. An air pressure system on top of the machine prevents the micro-droplets from going beyond the shoulder level, avoiding any ingestion of disinfectant fluid by the subject.

The machine can currently work for two kinds of disinfectant fluids—ethanol based (70%) and sodium hypochlorite. It has successfully been tested to neutralise any

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Yes! EFYs Electronics Industry Directory is being launched at the EFY Expo, which is being held on 24th & 25th March at Auto Cluster Center, Pimpri, Pune.

The new directory will ONLY list those suppliers who enable R&D or manufacturing of electronics. For example, list of Distributors of Electronics Components or list of Independent Design Houses to outsource R&D too.

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- Leading Distributors of **Components**
- Leading **Manufacturers of PCBs**
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- Leading Suppliers of **Manual (aka Hand-Held) Manufacturing Equipment** (OEMs & Resellers)
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- Leading Suppliers of **3D Printing Service Providers**
- Leading Suppliers of **Chemicals & Consumables**
- Leading **Testing & Certification Agencies** (BIS, UL, etc)
- Leading **Trade Associations Supporting Electronics Businesses**
- Leading **Government Agencies Supporting Electronics Industry**

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Barun Shahi

Nikky Kumar Jha

Meenakshi Kumari

infected area within a second.

Tested and recommended for use in hospitals by India's top medical bodies, including AIIMS, ICMR, and IMA, the full-body disinfectant machine was awarded the IMA National President Award in 2021. Shahi has filed for a patent for the machine, which is currently in the last stage of the grant.

The startup is engaging in a discussion with the state health department to deploy this machine in state healthcare facilities and hospitals. The company intends to commercialise the product after the patent grant is received.

A HOME FOR VEGGIES

Necessity is surely the mother of invention, and that is what prompted Nikky Kumar Jha, an alumnus of Nalanda University in Bihar, to come up with the idea of a green storage system for vegetables and fruits for farmers and retailers.

After watching farmers and vegetable vendors in his village Naya Tola Dudhela in Bhagalpur, Bihar, waste a large quantity of their produce due to lack of adequate storage facilities and electricity, Jha started working on a storage system in 2019 to increase the shelf life of fruits and vegetables.

Jha set up Saptkrishi Scientific Pvt Ltd and came up with a solar-powered storage device that requires a power supply of just 10 watts and one litre of water every day, whose production started in March 2021.

The device consists of a high-humid and sterile isolated chamber made of nano-surface reflective coating material. An ARM based embedded system device with a programmable logic controller allows the user to select different modes of operation for different vegetables and fruits. It oxidises ethylene emitted by the produce into small molecules, thus delaying browning and ripening, and regulates the activity of the antioxidant enzyme. This creates a controlled microclimate that preserves fruits and vegetables for anywhere between 3 to 30 days.

Started with an initial seed amount of ₹1.5 million, the startup has set up a manufacturing facility that now makes 100 units per month. Each unit can accommodate 200kg of produce and measures approximately 122cm × 107cm × 76cm (4 feet × 3.5 feet × 2.5 feet). Priced at ₹10,000 per unit, the startup is collaborating with different microfinance companies to assist its target customers, which include the local vegetable vendors and farmers, get the product on an EMI basis.

The company plans to collaborate with different state governments to help the farmers get the product at a subsidised rate. The company has sold more than 500 units in different parts of the country till now and has an order of 750 units in its pipeline.

Aiding innovators from all walks of life, incubation centres like IIT Patna aren't just looking at degrees and backgrounds but assessing ideas and supporting them to develop products. What remains to be seen is how these products effectuate the purpose of their invention and become a part of our daily lives. EFY

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5.9 million tonnes of lithium deposits found in J&K

The Geological Survey of India (GSI) discovered a huge reserve of the shiny grey metal lithium, a crucial mineral for the manufacture of solar panels and electric vehicles, in the Reasi district of Jammu and Kashmir. Lithium is also called 'white gold' because of its key utility in the making of lithium-ion and other electric batteries. Being considered very good news, especially for the electronics industry, experts recommend caution to sustainably extract the resource from the fragile ecosystem of the area.

Digi-Key launches Global Capability Center in Bengaluru

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Leading electronic components distributor, Digi-Key Electronics, recently launched the first-of-its-kind Global Capability Center (GCC) in Bengaluru. The nearly 2,800 square metre (30,000 square feet) facility in India was inaugurated in the presence of several key leaders from Digi-Key and its chosen implementation partner, SMC Squared (SMC2). As per the company, this facility will serve as an epicentre for technology and innovation for Digi-Key's operations globally, supporting the organisation in keeping pace with its suppliers' and customers' demands for services and innovation.

North India's largest floating solar project set up in Chandigarh

North India's largest floating solar project of 2,000kWp has been inaugurated at Water Works in Chandigarh, which is India's first planned city. While unveiling the floating solar plant, the Administrator of Chandigarh, Banwari Lal Purohit, also inaugurated a 500kWp floating solar project with fountains at Dhanas Lake in Chandigarh. Chandigarh Renewable Energy and Science & Technology Promotion Society designed and executed these projects, which are expected to generate over 3.5 million units of solar energy per year with 20% module efficiency.

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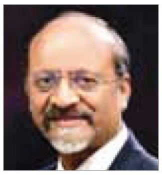
PEOPLE (on the move)

Dr Satya Gupta wins VSI Lifetime Achievement Award



Leading Indian body for very large scale integration (VLSI) design & semiconductors development, VLSI Society of India (VSI), felicitated the CEO of EPIC Foundation, Dr Satya Gupta, with The Lifetime Achievement Award. A high-level jury panel chaired by Sanjay Churiwala, General Chair, VLSID-2023 and Corporate Vice President AMD decided to honour Dr Gupta with the award at the 36th International Conference on VLSI Design & Embedded Systems held in Hyderabad. Notably, the award aims to highlight and recognise exemplary lifetime contributions by an individual to the Indian and global VLSI and semiconductor industry ecosystem.

Vedanta welcomes David Reed as CEO of its semiconductor business

With the appointment of David Reed as the CEO of its semiconductor business, Vedanta noted that he will be responsible for setting up a state-of-the-art semiconductor fab unit and semiconductor assembling and testing unit. Calling him a 35-year veteran in the semiconductor industry, Vedanta mentioned David's extensive international experience, including the establishment of a complete semiconductor ecosystem with global execution of wafer fabrication, research and development, assembly and testing, total quality management and packaging, and supply-chain management.

GreenCell Mobility welcomes Devndra Chawla as new CEO

Shared electric mobility player, GreenCell, has appointed Devndra Chawla as its new CEO to lead the company's objective of being the prime mover in building sustainable growth momentum in the shared e-mobility space. He will report to the board of GreenCell. An alumnus of the Harvard Business School via its Advanced Management Program, he has over 26 years of experience in varied domains. Before getting into GreenCell, he worked with Spencer's Retail and Nature's Basket as its MD and CEO. He was also associated with Walmart India and the Future Group.

Foxconn hires former Nidec CEO as strategy chief For EVs

Foxconn Technology Group has named former Nidec Corp. CEO, Jun Seki, as the chief strategy officer of its electric vehicle venture. This is the first high-profile hire for the iPhone manufacturer in a bid to strengthen the company's automotive aspirations. Foxconn has been eyeing the automotive sector for quite some time. It acquired a pickup assembly plant from embattled Lordstown Motors Corp. and showcased several prototypes. Seki left Nidec last year after working there for almost three years with the world's biggest manufacturer of electric motors. He was demoted from his position as CEO by company founder Shigenobu Nagamori after the latter blamed him for the company's deteriorating earnings.

Sony promotes CFO Hiroki Totoki to President

Japanese electronics conglomerate, Sony, has appointed veteran executive and chief financial officer, Hiroki Totoki, as its President and Chief Operating Officer (COO) to lead the company, after it reported a 6% decline in net profit for the quarter that ended in December. Totoki will take over from the current president, Kenichiro Yoshida, at the beginning of the next fiscal year. Yoshida would remain Chairman and CEO, signalling continuity at the Tokyo based maker of Bravia TVs.

EFI welcomes Frank Pennisi as new CEO

Electronics For Imaging, Inc. (EFI), a global leader in digital industrial imaging and portfolio company of Siris Capital Group LLC, has appointed Frank Pennisi as its CEO. Also, EFI separated its Fiery business unit as an independent company owned by Siris. Notably, both companies will have distinct areas of strategic focus, with EFI as an industrial inkjet leader and Fiery as a digital front-end (DFE) provider.

Quantic appoints Bill Heinsohn as GM of Quantic BEI and Thistle

Leading electronic component player, Quantic Electronics, recently announced the appointment of Bill Heinsohn as the General Manager of the company's position sensing business units, Quantic BEI and Quantic Thistle.

Reliance, Ashok Leyland unveil India's first hydrogen-powered truck

The India Energy Week 2023 in Bengaluru was witness to a historic milestone in India's journey towards green energy alternatives. Reliance Industries Limited (RIL) and Ashok Leyland together unveiled India's first hydrogen internal combustion engine (H2-ICE) powered heavy-duty truck. Powered by hydrogen, with its overall architecture similar to a conventional diesel based combustion engine, the H2-ICE heavy-duty truck (19-35 tonnes) has been under test since August 2022. Ashok Leyland and RIL had been working on this technology over the past year.

IISc Bengaluru and BEL to work together in AI/ML

At Aero India 2023, Navratna PSU Bharat Electronics Limited (BEL) signed an MoU with the Indian Institute of Science (IISc), Bengaluru, to work together in artificial intelligence, machine learning, and other emerging technologies. The partnership is aimed at leveraging their complementary strengths and capabilities. IISc will provide specialised services in AI and ML for BEL to initiate various projects in terms of the development of R&D solutions, algorithms, training for BEL engineers, etc.

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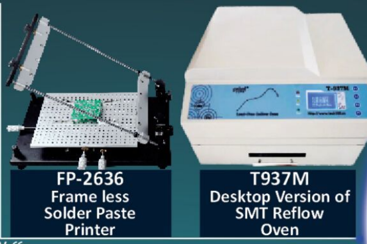
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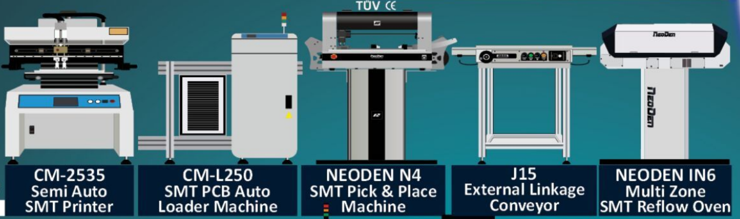
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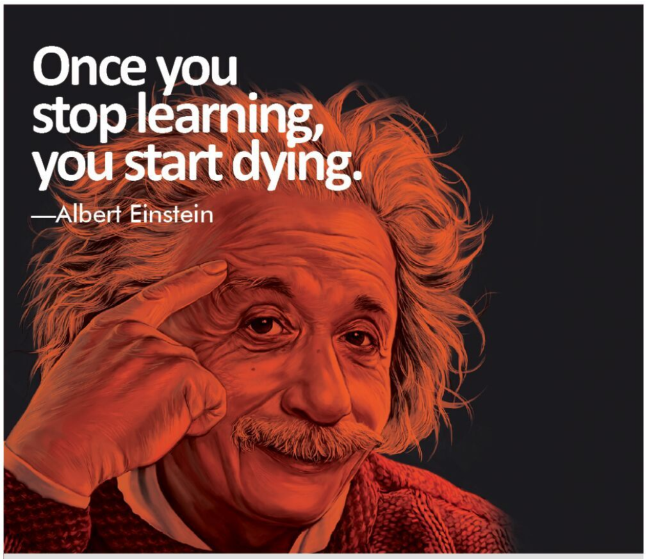
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Calendar of Forthcoming Electronics Fairs/Exhibitions/Seminars/Events

Event, Date and Venue	Topics	Contact address for details
Embedded World March 14-16, 2023 Nuremberg, Germany	The Embedded World exhibition and conference provides a global platform and insight into the world of embedded systems, from components and modules to operating systems, hardware and software design, M2M communication, services, and various issues related to complex system design.	Website: https://www.embedded-world.de/en
Electronics For You Tech Expo March 24-25, 2023 Auto Cluster Exhibition Center, Pune	Pune is one of India's fastest growing electronics and automotive regions. The Pune-Nasik-Mumbai triangle represents a market that's not been tapped by any major electronics event yet. Hence, Electronics For You team is taking the initiative to launch EFY Expo @ Pune. The expo is powered by MOVES—a unique conference targeting mobility, automotive, and EV sectors.	Website: https://www.electronicsforu.com/events/electronics-for-you-tech-expo
Open Source India 2023 October 12-13, 2023 NIMHANS Convention Center, Bengaluru	Open Source For You magazine, in partnership with India's Open Source community and industry, brings various stakeholders under one roof to accelerate development and deployment of open source in India, and beyond.	Website: https://www.opensourceindia.in
India Electronics Week February 7-9, 2024 KTPO, Whitefield, Bengaluru	India's No. 1 event for creators of smart electronics solutions to discover latest techniques, best practices and technologies for developing electronics better, cheaper and faster, and meet service providers, suppliers and partners who can enable growth of your business.	Website: www.indiaelectronicsweek.com
IoTShow.in 2024 February 7-9, 2024 KTPO, Whitefield, Bengaluru	The conferences and hands-on workshops, cutting-edge talks and trainings by industry stalwarts and thought leaders will help build the skills you need to get ahead in the field.	Website: https://www.iotshow.in

Since this information is subject to change, all those interested are advised to ascertain the details from the organisers before making any commitment.

ARAI launches fast charger for EVs and signs MoU

At the launch event of a 100kW DC fast charger designed and developed by the Automotive Research Association of India (ARAI), an MoU was exchanged between ARAI and ARAI-Advance Mobility Transformation and Innovation Foundation (ARAI-AMTIF), while ARAI-AMTIF signed MoUs with ten startups and MSMEs. The charger will considerably reduce the charging time of electric vehicles. ARAI is expected to soon launch advanced driver assistant systems verification and validation test facility, cylinder test facility, and Heit facility in Pune.

Fyn Mobility and Exponent Energy to roll out 15-minute chargeable EVs

Integrated electric vehicle ecosystem platform, Fyn Mobility, has partnered with EV charging startup, Exponent Energy, to roll out 1,500 electric three-wheelers in Bengaluru. The three-wheelers, called neEV Tez, result from an earlier partnership between Exponent and Altigreen. Combined with Exponent's e^pump network, Fyn would be able to operate the fleet of EVs that can be charged fully in 15 minutes.

ABB India's GHG emissions down across all manufacturing locations

In the latest update from the sustainability front, ABB India announced that it has achieved an 81.6% reduction in Scope 1 and Scope 2 greenhouse gas (GHG) emissions versus its 2019 baseline. The company believes that primarily its investment into renewable energy sources and the realisation of RE100 across its five manufacturing locations has aided the emission reduction. Five ABB locations across India—Nelamangala, Peenya, Maneja, Nashik, and Faridabad—are certified as 'Green Factory Buildings' by the Indian Green Building Council.

Aptiv opens technical campus in Bengaluru to support OEMs

Leading global technology company, Aptiv, recently inaugurated a new $14 million technical centre campus in Bengaluru. With a focus on developing safer, greener, and more connected mobility solutions, the Aptiv Technical Center in India has been developed as a key engineering and software hub. The over 22,000 square metre (237,000 square feet) facility was inaugurated at Brigade Tech Gardens, Whitefield, in the presence of the global leadership team and the employees. The company plans to aggressively grow its workforce over the next five years.

BrightNight to set up differentiated wind-solar power project

Leading renewable power producer, BrightNight, has announced its plans for one of its inaugural projects in India—a differentiated 100MW co-located, wind-solar hybrid renewable power project that will deliver clean, high-capacity factor power to commercial and industrial customers.

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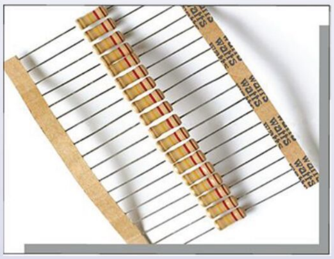
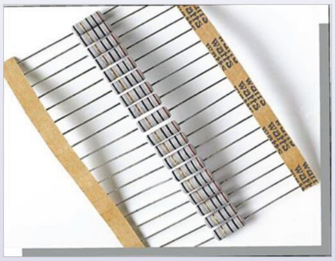
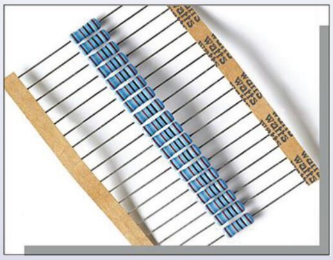


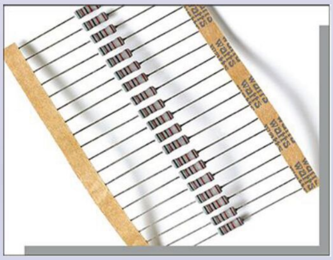
Carbon Film Resistors



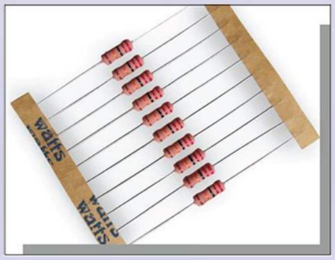
Wire Wound High Surge Silicon Coated Resistors



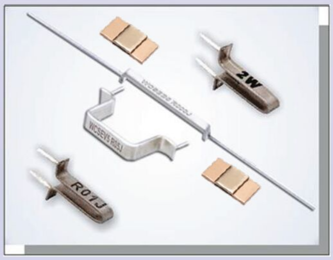
Metal Film Resistors



Metal Oxide Resistors



Metal Glaze Resistors



Low Ohm Current Sensing Shunt Resistors

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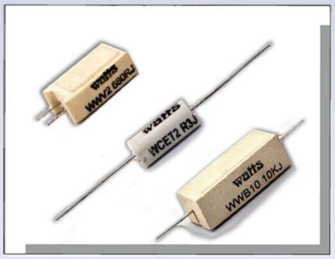
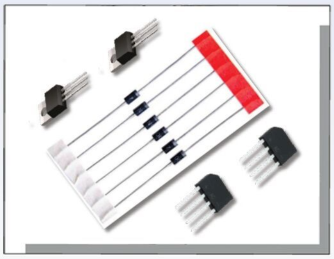


Wire Wound Ceramic Encased Resistors

Sleeved Resistors

Chip & MELF Resistors



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The company used its proprietary software platform to develop the Optima project in Maharashtra. The renewable power project is believed to meet up to 80% of C&I customers' power consumption and potentially save customers up to 25% annually on their energy bills, while avoiding carbon emissions equivalent to up to six million tonnes for project life.

SNIPPETS

- At India Energy Week 2023 in Bengaluru, Prime Minister Narendra Modi flagged off commercial roll-out of the twin-cooktop model of Indian Oil's indoor solar cooking system
- Nokia has extended their fibre broadband equipment manufacturing into India
- Rapido and RACEnergy are collaborating to deploy electric autos in India
- Gizmore is set to make one million smartwatches with Optiemus Electronics in India
- Nissan is to buy 15% stake in Renault EV unit
- ThomasLloyd Energy Impact Trust acquires renewable energy company SolarArise
- Servotech partners with Dubai based firm Al Ansari Motors for EV charging solutions
- Omega Seiki Mobility and Mufin Green set to finance 7,500 electric three-wheelers by 2024
- onsemi and Volkswagen join hands for SiC Tech in next-gen EVs
- Homegrown EV charging and mobility solutions company, Magenta Mobility, has raised $40 million in its Series B funding
- Nissan and Hitachi partner to run elevators using EV batteries
- Michigan based energy storage technology company, Our Next Energy Inc. (ONE), raises $300 million and is set to launch LFP cell factory
- Netflix collaborates with General Motors to accelerate the mass adoption of EVs
- Rohde & Schwarz joins hands with Chemnitz Univ for R&D in cybersecurity
- Draganfly collaborates with RSI to manufacture drones in India
- Tamil Nadu to develop $100 billion electronics industry by 2025
- Zypp Electric raises $25 billion in Series B funding round
- Hero Electric and Dhoot Transmission to partner for wiring harness solutions
- MediaTek joins Skylo on next-gen 3GPP NTN satellite solutions
- Fujitsu develops supercomputer system for numerical weather predictions
- indie to acquire GEO Semiconductor for camera based sensing solutions
- Faridabad based residential solar tech startup, Loom Solar, gets $2 million from SIMA Funds, USA
- Commercial EV platform, Turno, raises $13.8 million to build proprietary battery tech
- Switch Mobility delivers 22 double-decker electric buses to BEST Mumbai
- Exatron enters into networking products manufacturing
- Garuda Aerospace enters defence sector with solar-powered drone 'SURAJ'
- Global supply-chain and manufacturing solutions provider, Flex, opens their third Global Business Center in Coimbatore

India's first autonomous drone to fly in underground mines

An emerging Indian player in aerial intelligence, Squadrone, flew autonomous drones in underground mines in India. It became the first company to do so after successfully completing a proof of concept at Hindustan Zinc's (Vedanta) underground mines in Udaipur, Rajasthan. After its successful completion, the company said that the application of drone based Hovermap lidar technology would bring about a huge transformation in the way underground mines are worked in India. Squadrone aims to utilise its American and Australian partners' tech to drive digital transformation and implement lidar technology inside mines.

IESA conducts 2-day national seminar on semiconductors

India Electronics and Semiconductor Association (IESA) recently conducted a two-day national seminar on 'Semiconductor in India: Challenges and Opportunity' in Gandhinagar. The seminar was attended by nearly 500 industry experts and engineering students. The seminar covered various aspects of semiconductor manufacturing, the creation of fabless entities, the setting up of OSAT facilities, and promoting and widening electronics manufacturing in India.

Apple likely to raise India production iPhones to 25%

Apple Inc. wants India to account for up to 25% of its production from the current 5-7%, Piyush Goyal, Minister of Commerce and Industry, told at a conference. "Apple, another success story," Piyush Goyal said, pitching India as a competitive manufacturing destination. "They are already at about 5-7% of their manufacturing in India. If I am not mistaken, they are targeting to go up to 25% of their manufacturing. They launched the most recent models from India, manufactured in India." The iPhone maker has reportedly been trying to move its manufacturing away from China. The company started manufacturing iPhone 14 in India in September 2022 at Foxconn's Sriperumbudur facility situated on the outskirts of Chennai.

Sun to power 500 Telangana government schools by March

In accordance with the last year's announcement to install rooftop solar systems in 1,521 government schools, the Indian state of Telangana will have over 500 government schools with access to solar power

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INTERNATIONAL news

Navitas acquires silicon control IC company

An industry leader in gallium nitride (GaN) power integrated circuits, Navitas Semiconductor, announced an agreement to acquire the remaining minority interest in its silicon control IC joint venture from Halo Microelectronics for a purchase price of $20 million in Navitas stock. The addressable market potential for this additional silicon controller capability is approximated at over $1 billion per year by 2026. It is noteworthy that Navitas and Halo created a JV in 2021 to develop application-specific silicon controllers that are optimised to work in combination with Navitas GaN ICs to improve efficiency and density.

Next phase of RS DesignSpark engineering community ready

RS Group plc, a global omnichannel provider of product and service solutions, recently announced the launch of the next phase of DesignSpark, the fast-growing online community of RS for engineers. Its offerings include design tools like DesignSpark Mechanical and DesignSpark PCB, comprehensive 2D/3D and electronics part libraries, and design resources like tech articles, projects, and community forums. Starting from 'DesignSpark Explorer' to 'DesignSpark Creator' and finally to 'DesignSpark Engineer,' the three subscription levels for members aim to enable suitable access as per their requirements for design tools and resources.

American LG TVs to feature Auxuman's metaverse gaming

Leading player in the AI gaming industry, Auxuman, recently announced a partnership with a metaverse technology platform, Oorbit, to bring metaverse gaming to LG Electronics customers. The facility started on January 31 of this year. With Auxuman's AI game creation platform called 'Auxworld,' the current collaboration will enable anyone to create an online multiplayer game through text input in a manner similar to popular AI image generators. Auxworld claimed that harnessing the power of generative AI will empower anyone to create endless multiplayer game sessions easily, quickly and affordably.

Shell and Sun Mobility partner for battery swapping in Philippines

Shell Inc.'s Philippines based subsidiary has partnered with Bengaluru based Sun Mobility to deploy the latter's battery swapping stations for two-wheeler and three-wheeler electric vehicles at its outlets in the Philippines. A selected number of Pilipinas Shell Mobility stations will soon deploy swap points that leverage Sun Mobility's swapping technology consisting of smart batteries, quick interchange stations, and smart network (cloud based IoT backend software). This will allow two-wheeler and three-wheeler electric vehicles to swap batteries at Shell mobility stations in less than two minutes and provide a cost-effective solution with a significant range. The project is expected to launch within the first half of 2023.

Honda and GM partner to develop hydrogen fuel cell

Japanese automaker Honda Motor Co. announced that it would collaborate with US based General Motors (GM) to produce a new hydrogen fuel cell system and gradually increase its sales this decade to expand its hydrogen business. At a company event in Tokyo, Honda's Senior Managing Executive Director Shinji Aoyama said that the company would commence production of the fuel cell system through its joint venture with GM this year. The global hydrogen fuel cell vehicle market is estimated to generate $43,208.3 million by 2031.

Powertrain developer Vitesco Technologies joins Polestar 0 project

German electric mobility solutions provider, Vitesco Technologies, has joined the Polestar 0 project to create the world's first entirely carbon-neutral vehicle. The company will assist the Swedish electric vehicle manufacturer to develop the power electronics to achieve a zero-carbon emissions inverter for the production vehicle application in 2030. The German automotive supplier for drivetrain and powertrain technologies has set the goal of being carbon neutral across its entire value chain by 2040.

Japanese Terra Drone secures $14 million from Wa'ed Ventures

Terra Drone Corporation, a leading drone and Urban Air Mobility (UAM) technology provider, recently raised $14 million in funding from Wa'ed Ventures. The newly-funded company plans to set up a new subsidiary, Terra Drone Arabia, for its operations in Saudi Arabia to conduct drone surveys, inspections, and unmanned traffic management (UTM). Terra Drone's plan is in line with the Saudi government's Vision 2030, which it first announced in 2016 to stimulate economic transformation by reducing the country's dependence on hydrocarbons.

by March. The state government put forward its solar plan for these schools last year at a cost of ₹3.2 billion in 12 districts. The schools with over 200 enrollments have been selected for the installation of rooftop solar panels. As per officials, solar panels have already been installed in over 100 government schools by now.

GlobalLogic expands into SW Europe with digital centres in Spain

GlobalLogic recently unveiled its plans to open new engineering centres across Spain. The President & CEO of the company, Nitesh Banga, said this during a meeting with the Spanish Prime Minister Pedro Sanchez. The company mentioned that the Spain centres will represent GlobalLogic's first sites in Southwest Europe, adding to over 20 existing EMEA locations across 9 other countries. They will be charged with providing design-led digital engineering services to global and Spanish clients in both on-site and off-site support models, depending on customer location and need.

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PRODUCT DEVELOPMENT
Through Concurrent Engineering

The initial QFD analysis that we did in our previous article helped to develop a draft product definition. This product definition needs further detailing and has to go through several iterations before we get our concepts cleared and develop a marketable product plan

SOUMYANATH CHATTERJEE is former TVS Motors Chair Professor at Industrial and Systems Engineering Department, IIT Kharagpur. His expertise is in Product Development and Supply Chain Management

In our previous articles on developing a charge controller for wind power, we discussed the features it must have to make the product attractive. We also used the quality function deployment analysis to discover the features, components, manufacturing process, and quality assurance approach of that charge controller.

The draft plan we made so far needs expansion with further details. For instance, we need circuit diagrams, PCB design, product packaging, user manuals, manufacturing plan, sources for materials, marketing plans, budget, pricing, etc. All these skills are not available to a single person, so we need people with electronics engineering, supply chain planners, package designers, embedded software designers, accountants, web developers, and a marketing team.

When we start defining the product, we have too many options and very few details about what we plan to make, its features, design, manufacturing plan, supply chain structure, distribution plan, pricing, market, etc. The initial QFD analysis that we had done in our previous article

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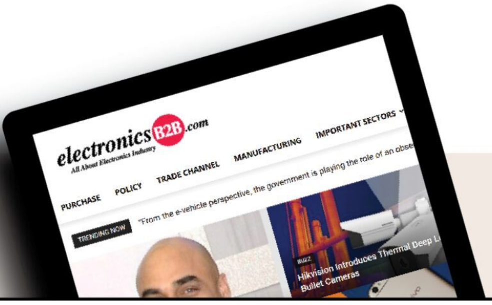
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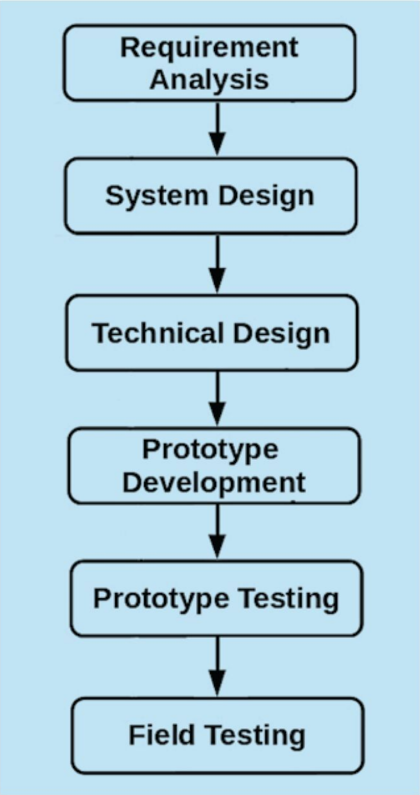

Fig. 1: Waterfall development model

helped to develop a draft product definition. This product definition needs further detailing and has to go through several iterations before we get our concepts cleared and develop a marketable product plan.

There can be various paths of product development. In technical language, we call this path a development model. Each of the product development models has certain advantages and certain drawbacks. The first decision we take in product development is to decide on this development model. Let us look into some of the popular development models and understand where to use which one.

Waterfall model

The traditional approach to product development had been to start with listing the requirements of the product. Once these requirements are frozen, then the product architecture is defined. Then the technical detail design is made, which is followed by an implementation plan, design verification, maintenance plan, distribution plan, and marketing plan. This model is called the waterfall development model (see Fig. 1).

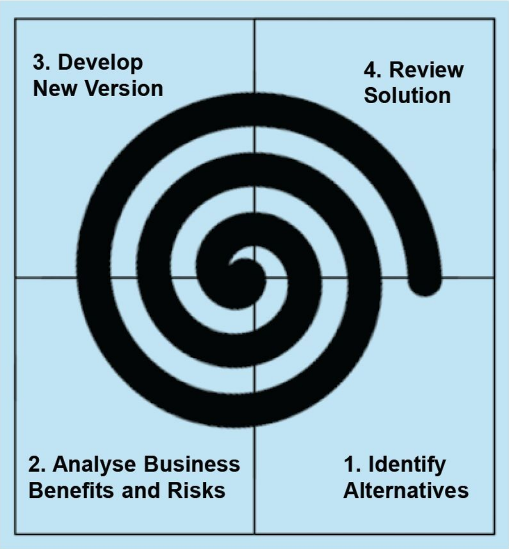

Fig. 2: Spiral development model

The waterfall model simplifies communication between different skill groups. In this model, each group works on the product concept at a time. Once a team finishes its work, it hands over the outcome of its work to the next team. In the days when communication facilities were in their infancy, computing resources were very costly, and waterfall model was the only option available to product developers. In those days, this model worked nicely.

The problem with waterfall model was the time taken to develop a product. Each team worked in a sequence, which resulted in a long delay between product conceptualisation and its realisation.

The second problem was the lack of interaction between different groups. This lack of interaction often resulted in manufacturing difficulty, poor quality, and maintainability. At times, such poor interactions resulted in costly changes in design and manufacturing processes at advanced stages of development.

The waterfall model is not suitable for developing complex products.

Concurrent engineering

These days we use a process called concurrent engineering (CE). In the CE approach, evaluation, designing, and planning happen together. Team members with different skills get involved in the designing process right from the beginning and evolve the product by working together.

Let me give you a small example of how the involvement of members from different functional groups helps to improve product design. This author was developing a control system of an automated press for making compressed earth blocks. In the press, a mixture of soil and cement is compressed to form blocks. These blocks are an environment-friendly alternative to terracotta bricks.

Manufacturing of these blocks required close dimensional tolerances. As the ram presses the soil it has some inertia. For this reason, power to the ram needs to be cut off ahead of the endpoint. The distance the ram travels after power cut-off is governed by the plasticity of the soil. This property varies widely from batch to batch. Sensing the point where to cut off the power posed a challenge with conventional sensors.

During the prototype trial of the press, one of the production team members came up with the idea to fix a stopper at the endpoint. He suggested using the sound ram made when it hit that stopper as the sensing system for adjusting the endpoint sensor. Under normal conditions, the ram will touch the stopper with a soft click. If the clicking sound is missed, then he will lower the sensor. If the ram made a hard clapping sound, then he will raise the sensor. That operational innovation greatly simplified the design and improved dimensional quality of the bricks.

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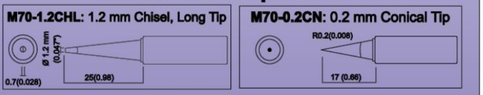
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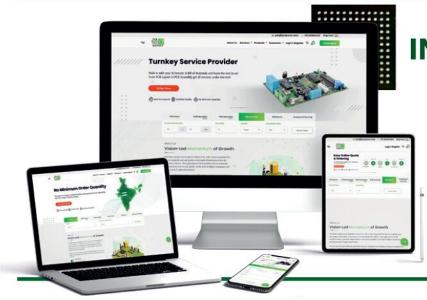
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involving computers, the internet, and video conferencing enable us to interact with people often sitting at different geographic locations easily. In the concurrent engineering approach, the team will discuss and evolve design ideas on a real-time basis. In this process a large number of iterations are possible.

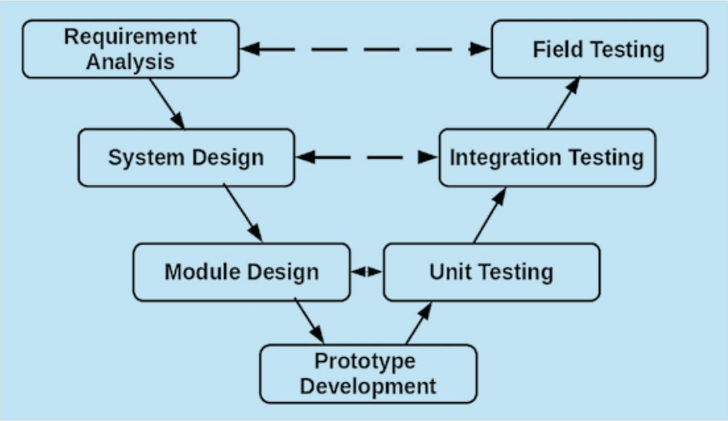

Fig. 3: Vee model

Spiral model

The spiral development model is one of the simplest concurrent engineering approaches (see Fig. 2). In this model, development happens through many development workshops or sprints. These are intense and focused interactions involving all team members to achieve a specific goal. There is no rule on the number of sprints in the spiral process. During the sprint, the team will go through a cycle of planning, developing, evaluating, and suggesting further improvements.

The product development plan starts with a sketchy concept. It gradually evolves into a proof of concept mock-up, a working prototype, pilot samples for test marketing, and finally the marketable product.

The spiral development model enables rapid product development. It uses rapid prototype development technologies like 3D printing, CAD-CAM, simulation, etc. In the spiral development model, all team members can work together.

For instance, while the designers are making a circuit design, the supply chain team can use the shared bill of materials to develop suppliers. The costing team can work out the production economics, while the production team can plan their production strategy right from the start of designing. Each of these teams gives their feedback and works out the best possible options.

Vee (V) model

A spiral development model faces the challenge of keeping the focus on the original requirement. As the project becomes large, the team tends to lose focus. We also have the challenge of engaging a widespread, complex team for fruitful discussions. In 1979, Barry W. Boehm proposed another model primarily for software development, which is now known as the Vee model. For product development Vee model is quite popular.

The Vee model is an extension of the traditional waterfall model. In this, the distinct phases of the waterfall model and the spiral model are superimposed. This results in distinct phases of conceptualisation, development, and validation. In the Vee model validation phases are tied-up with conceptualisation phases (see Fig. 3).

The structure of the Vee model enables us to engage smaller and focused teams at different phases of product development. Unlike the spiral model, Vee model phases have a specific and well-defined deliverable. This structure helps to manage the project, track progress, and keep the team focused on main requirements. Unlike the spiral model, the author has worked with a development team that comprised around seventy members spread across five continents successfully using the Vee model.

While popular, the Vee model is criticised for being too rigid. Where requirements are fuzzy and contain a high risk of changing, the Vee model is not suitable. In such a situation, it is often advisable to rapidly get a small product lot in the market and gradually evolve the product in continuous new version releases. We see this practice in operation in high technology products like cell phones, operating systems, computers, etc.

Apart from these, there are many other development models. We have to select the correct development model for the product. No model will fit all sorts of products. Each of them has certain advantages, and each of them has certain disadvantages. However, the popular models described here will fit the most common product development requirements.

The waterfall model is good for the development of our charge controller. It is a small and simple product and will not require a large team or much development effort. But we shall use the Vee development model to demonstrate the process.

Requirements for CE

Concurrent engineering processes need some basic infrastructures. First of all, there has to be participation from all functional departments. The development team should have dedicated members who are knowledgeable and empowered to take decisions. Preferably. The development team should sit together. If that is not possible, they must meet in a well-defined periodic manner and devote specific time to the project.

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Next, the team should have a shared document repository. Preferably, it should have a version control system. There are various version control software options. Some are proprietary software. Under open source, there are options like Subversion. Concurrent versioning systems (CVS), Git, etc. Even the most common office software products like Microsoft and Open Office suits have options to document and monitor changes. The team should adopt any of these options and maintain a change history.

Under concurrent engineering development processes, many changes will happen in parallel. Some of these changes will have inter-relations. When we make any change in the design or processes its impact on the other related areas needs to be evaluated, and the agreed changes incorporated into the documents.

It is a good practice to mention the related steps in each document. Establishing a lookup table with the document dependencies and the latest version numbers is also a good idea. Such documentation helps to ensure proper analysis of changes and helps to avoid unnecessary work of checking change impact for unrelated areas.

Development stages

We shall look into the stages of the Vee developmental model with the example of the charge controller. So far we have completed the requirement analysis phase. Next, we shall do system design. Requirement analysis gives us the product specifications and its basic modules. System design takes these inputs to evolve the technical drawing of the product.

During system design, our main task is to explore various technical alternatives and finally select the basic technical configuration of the product. Each of the steps in the Vee model has specific tasks and deliverables.

ACTIVITY, DATA ACCURACY REQUIREMENTS AND DELIVERABLE OF EACH STAGE

Stage	Main Activities	Data Accuracy	Deliverable
Requirement Analysis	• Understand basic requirements from the product	• Ball park figures for technical and financial analysis	• Product specification • List of modules • Rough business case
System Designing	• Technology selection	• Published figures from supplier catalogue and technical literature	• Product block diagram • Basic POC model
Module Design	• Technical drawing	• Published figures from supplier catalogue and technical literature	• Engineering drawing • Detailed business case
Prototype	• Develop prototype • Select suppliers • Make or buy decisions	• Accurate technical details, fairly accurate market projection	• Bill of material • Manufacturing plan
Unit Testing	• Validate prototype in controlled environment • Estimate product price and market demand	• Accurate technical details, accurate market projection	• List of suppliers • User manuals • Marketing plan
Integration Testing	• Performance testing • Distribution channel selection	• Negotiated contracts with suppliers	• Detailed manufacturing plan • Quality assurance plan • Product distribution plan • Product packaging design
Field Testing	• Sample testing in real life use • Product launch planning • Stocking finished products at sales outlet	• Negotiated contracts with suppliers and distributors	• After sales support plan • Manufacturing schedules • Sales force training material

As we progress in these stages, we also make our cost and profitability projections more and more accurate. The initial stages start with rough ballpark estimates. Initially, we have little idea about the product, so we select our alternatives using published data and guidelines. As we get more and more clarity on our final product, we also collect accurate information. The table above gives the details of the activity, data accuracy requirements, and the deliverable of each stage.

Gateway review

In the Vee development model, we re-evaluate our business plan at the end of each stage. We evaluate it for technical and commercial viability after incorporating our new learning. The learning will come from the collected information and experience gained from the prototype development, trial, and the environment.

Product development is a time taking activity. Many things change during the development of a project. New technologies emerge, policies shift, prices change, and other competitors may come out with some new products. All these changes have an impact on the business case of the product.

At the gateway review, a decision will be taken on Go, Rework, or Drop the development project. An assessment of the risks and an honest evaluation of the project are always required.

Delay in calling a nonviable product development project causes unnecessary investment and time. If we look around, there are plenty of examples of companies that have gotten into financial trouble for such delays in dropping their nonviable business plans. Periodic evaluation and risk assessment are equally important as technical development.

In our next article, we shall use these concepts for evaluating various technical options and learn about the economic evaluation of the product development project while developing the system design. EFY

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Growth

“We IMPORT DEFECTIVES From 50 To 60 Countries, REPAIR THEM And SEND THEM OUT”

What is Flex doing in the field of ‘circular economy’? How does this business operate? How do they help customers reduce their environmental footprint and maximise value recovery? To find answers to these questions, Rahul Chopra spoke to Nikhil Rao, General Manager, Global Services and Solutions at Flex in India. Here are the key excerpts of the discussion

NIKHIL RAO
GENERAL MANAGER, GLOBAL SERVICES AND SOLUTIONS BUSINESS, FLEX, INDIA

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Can you share a bit about your experience at Flex?

I started my career with Flex 17 years ago as a graduate engineer trainee and now I head one of the business verticals for Flex, called Global Services and Solutions, which offers circular economy solutions, focusing on aftermarket services like repair to spare parts management, forward and reverse logistics. To elaborate further, at Global Services and Solutions in India we provide returns and screening, complex repairs, CO_2 reporting and analytics, asset recovery and parts harvesting. Flex is an amazing company that gives you great opportunities to work and have a great career. I completed my Senior Executive MBA from the Indian School of Business (ISB) and I was supported by Flex in managing time and work.

How has the electronics sector evolved over the years in India?

Fifteen years ago, all the companies in India were struggling to get a foothold in electronics manufacturing, but since then, it has taken great shape. Our investments in the space in Bangalore, and specifically Chennai, have been very interesting. We've remained invested, and we knew that the time would come when India would grow as an electronics repair hub.

We are happy to have been through this journey. There were tough times when we tried to convince customers to come and place their business here. But today every customer wants to look at India as an alternative to a manufacturing hub. They are very interested in working with us, and a good amount of business is also coming into India in electronic repairs and refurbishing.

Today, I can proudly say that India has transformed into a manufacturing hub and is in the phase of transforming into an international repair hub.

Can you help us to understand the focus of the Global Services and Solutions (GSS) division?

We have been doing repairs for the biggest brands for more than 20 years now and the expansion to areas like Bangalore in 2004 is a testament of our global reach.

Today, we have two state-of-the-art repair/refurbishment sites, also called the Circular Economy hubs. Here, we are focused on providing circular economy solutions for products that are not only coming from domestic market but also imported internationally for repairs and return, and we usually do a lot of complex repairs. We import defectives from 50 to 60 countries across the world, which arrive in Bangalore, where we repair and send them out to their respective destinations. It's a circular economy repair hub, which serves certain customers and products across the world. We are bringing in high technology products and training our technicians, getting them up to speed to repair such kinds of products.

How would you define the circular economy? Are you referring to products that can be refurbished and resold?

Generally, products have linear product life cycles, that is, you build, you use, and scrap. This is how products were designed in the past. But now, many companies are working toward ambitious sustainability goals, like net-zero and zero waste, and looking at solutions to help them deliver on their commitments, including exploring circular practices. Today, products can be designed to support more circular product life cycles and progress can be made through aftermarket services.

Companies are putting in extra efforts to design products with components which are sustainable. After that, there is use followed by reuse, which in a linear model used to be scrapped. This reused product can be repaired, or refurbished, and it can be resold, or recycled in itself.

So, from a linear product lifecycle, what has evolved today is a circular product lifecycle. As far as the circular economy is concerned, what we are focused on is related to repair, refurbishment, and getting the best economic value through the entire product lifecycle. That's the focus of Flex's Global Services and Solutions.

How do these products come to the OEMs and how are they captured and returned?

OEMs who sell their products are giving warranties and out-of-warranty services. When it comes to warranty service, the OEM is responsible for the repair, refurbishment, or replacement of the product. Hence, a large portion of the returns that are coming to us are warranty based.

At the same time, for out-of-warranty returns also we use standard repair and test process and genuine spare parts and make the products more reliable. Even the out-of-warranty cases come back to us, but 70%-80% of the cases are in warranty and 20% of the cases are out of warranty. We convert these products (given by our customers) into reusable products which are as good as new.

Our portfolio consists of diversified products such as smartphones, hard disks, computing equipment, high-end routers, switches, telecom, 5G or 4G type of base station products, as well as spares of large format presses which have mechanical and electromechanical parts. Now, it depends on how the customer wants to reuse these products—repair or get a replacement.

Are there different teams that specialise in different kinds of equipment, or can you train similar people to handle different types of equipment?

When these products come to us at our repair centre, we need the best technicians, who have that specific knowledge about a product. Our technicians undergo intensive training for two to three months to understand the product, the debugging and the testing process. As it's a very different service from manufacturing, the skill set required for the repairs is very different. We train people to ensure they have the specified product knowledge and subject matter expertise.

At the same time, we also do some cross-training. We take some of the best technicians and move them into other product lines as well. For example, if a team of technicians is repairing a 5G or 4G base station, we take a few technicians and move them into the router and switches project, after one or two years, so that they can understand that part as well. For this switch, they have to go through training for approximately three months and when they need to go back to the 4G repairs, they are again put through refresher training.

This way we are creating a technician talent pool

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GSS India

that has the experience of managing diversified products.

How do you manage CO_2 reduction when the product is coming from some other destination by flight to India and then going back by flight to that country?

Let me explain by sharing an actual case study. Bangalore was established as a repair hub for one of the OEMs which collected all these returns from Asia and shipped them to Europe or the US. There was no Asia repair hub back then, but now all the Asian defectives are coming to Bangalore. The distance and time taken to send a product for repair in India is much less as compared to sending it to the US or Europe.

The argument could be why not in-country repairs? However, please keep in mind that not every country can set up their repair shops. There is a huge investment needed to test equipment and invest in capital expenditure. Countries with lower volumes of repairs cannot set up a repair hub. You have to consolidate it and send it to a country where there is a repair hub. In Asia, Bangalore and Futian are strategic repair centers for many of our customers in consumer devices, lifestyle, cloud enterprise and computing (CEC) and industrial segments.

Our customers found that it was not economical to repair some products in Europe and the US because of the labour rates and the time it takes to repair them. India's labour rates are much lower than the US. As such, products that have been declared as beyond economical repair can be repaired here. We are thus reducing CO_2 emissions via our regional repair hub and focussing on reducing scrap by enabling cost-effective repairs.

What are the most common issues in non-circular designs that you encounter and wish the OEM or the design team had thought about this?

The placement of components is very close. Let's take the example of a Ball Grid Array (BGA)—if you keep it too close to some of the other components, it becomes extremely difficult to repair or rework. Sometimes the design is such that they place a certain component which has a higher failure ratio or choose certain components and products from the market which are not reliable.

A lot of components that are being sourced for some products are very customised, and the possibility of circular economy or repairs becomes an issue. In such cases, we recommend to OEMs to try and make the components more agnostic so that component sourcing does not become a huge challenge. At times, you don't get the specific component that failed and need only that specific one which is not in the market, then the whole product will have to be scrapped. So, we continue working with and advising our customers to think about design for circularity best practices for easier repair and reuse.

Do most of the repair products sent by global customers go back?

The mandatory requirement for any product that comes for repair is that it needs to be returned. It's a customer-related policy, which we strictly follow. So, 100% of these units have to go back including the scrap. If you are getting 100 products with 100 serial numbers, you will need to send these 100 products back, because you cannot scrap or use these products here.

To what factors do you attribute the rising demand for repairing and refurbishing electronic products in companies such as Flex? What other segments will have high growth potential?

The mindset of OEM companies has changed from linearity to circularity, which will bring volumes into companies like Flex, allowing us to repair their products. Then there are environmental and economic advantages of repairing and refurbishing a product, instead of scrapping it. Customers are maximising the value of their products and components in addition to the environmental upside. Reduction in disposals reduces CO_2 and waste. This is going to drive the circular economy and volume, which is our focus.

Emerging products of the future, such as EV batteries, will also create a huge demand in both domestic and international markets. EFY

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Moving From MINIMUM VIABLE PRODUCT To A VALUABLE PRODUCT

Nobody wants a product that is minimally viable. Even you, for that matter, won't prefer that just minimally viable product. Would you?

ANAND TAMBOLI is a serial entrepreneur, speaker, award-winning author, and an emerging-technology thought leader

The idea of a minimum viable product, aka MVP, is not new and certainly not ground-breaking anymore. In fact, it is becoming, to put it mildly, outdated. As much as this may seem shocking to you, it is my observation and finding over the last several years. A more comprehensive way to look at this is to treat your products and services as smaller packages that are part of a larger offer.

Classically, we have always treated MVP as a product or service with a minimum set of features. It is supposed to have features that are necessary to be viable and useful to customers, nothing more, nothing less. The whole idea was to keep it simple, easy, quicker to develop, and reduce the time to market testing.

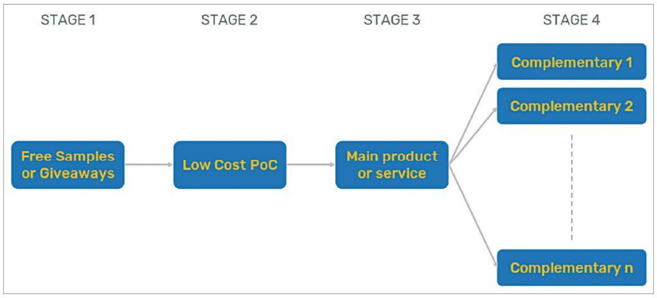
This approach allowed companies to validate their ideas and ensure they solved real problems for their target market, well before putting all bets on their idea. Even for a well-established business, MVP feels like the best way to go.

All the reasons that startups would use to go with MVP still apply to these businesses. It may be to test the viability of the idea in the market or gather feedback and prioritise further development, or both. All in all, MVP seems like a safer way to go in most cases.

Moving beyond MVP

So here comes a new challenge, as the concept of MVP is becoming outdated. In my recent interactions with entrepreneurs and their customers, it is becoming clearer now.

A product with just a few useful functions and features seems like a lazy offer. Customers have shown apathy towards such offerings. They won't necessarily reject it on the face, but they certainly would choose something incrementally better and more functional and feature laden.



Four stage product ecosystem

Why? I asked a few dozen customers out of curiosity. Their response can be summarised as, "I don't want to be a guinea pig for someone else's benefit." While this seems like a legit reason, there is some profound learning in it; and that is—nobody wants a product that is minimally viable. Even you, for that matter, won't prefer that just minimally viable product. Would you?

How to test your idea

Many entrepreneurs and small businesses grapple with a proper way to test their idea, sometimes unknowingly. They see a cold response to their MVPs and yet cannot reconcile their theory, hypothesis, and estimations with reality. Eventually, those who develop so-called MVP further into a product and go out in the market find a thread of hope. People respond better this time.

I have seen this first-hand with my company's products and services. When we reached out to potential customers with just the MVP, we received polite appreciation. In some cases, there were a few comments and suggestions. But none were like good feedback would have gotten us.

The problem we eventually realised was that those customers couldn't test our MVP in their environment as-is. Either it was too skinny from a functionality perspective, or it felt incomplete (which is what MVP is anyway) compared to a full-blown product.

So, for us to be able to test our ideas, we had to take a few extra steps. We would develop applications for our products and services that prospective customers could use. Let's call them proof of concepts (PoC), but much more than the traditional PoC. With these PoC, customers were able to fully visualise how our products or services could fit into their own workflows or complement their products and services.

But you have to note one thing here. A PoC is better than an MVP by all means—by cost, by development time it takes, the resources it needs, and the functionality it needs to have to work properly. There is hardly anything that is 'minimum' here.

What if PoC costs more

Well, if a PoC costs more than the MVP, the best course of action is to stop treating PoC like a MVP—which it is not. A better way is to start looking at your products and services is to build a product ecosystem. As a part of that ecosystem, you can have something that is better than MVP and thus makes more sense for the customers to try and test.

It also means that you will have to treat them like one of the offerings instead of just some test samples. It raises stakes for your business as there has to be a full support system to back things up. But it also means two more things—first, you will be able to sell them, and second, you can expect better feedback than what you'd get with a bare MVP.

However, when I say product ecosystem, I don't mean a bunch of different variants of your offerings. I mean several complimentary products and services that vary in form, function, and price.

Product ecosystem

By product ecosystem I mean a network of interdependent products and services. These products or services are interconnected but are mutually supportive of each other. Some of the elements in this product ecosystem can include the main product itself along with complementary products and services that are known as accessories.

It also includes supporting infrastructure and the people and organisations that use and support the product. A simple example of supporting infrastructure could be app stores, service providers, repair services, and accessories like cases and chargers.

This is one aspect of a product ecosystem that mostly varies by form and function. However, from a pricing perspective, there is another way to look at it. Can you imagine how difficult it becomes if you have only one key product or service to sell? Negotiations are way tougher, and it directly affects margins.

The key reason why negotiations get tougher is the perspective gap in the value this main product or service delivers. Customers don't have a clue about what it could be, or do, so they underplay it. We think it's the best thing they could get, so we stick to our ground. As a result, the needle doesn't move, unless someone backs down—which in most cases is your business.

I remember all our past negotiations and how we used MVPs to anchor the customers' perspective each time. However, since their perception was totally different compared to our MVPs, it did not help. But all the PoC we delivered pegged us differently in the sales process as they had reasonably comparable points of reference.

And that brings me to the point that your product ecosystem needs to have PoC (you could give it a different name though) as an entry-level offering amongst other complementary items. Think of it as a more economical offer you can make to your customers without having to justify a large investment in your product or solution.

A four-stage product ecosystem

Let's understand what a four-stage product ecosystem looks like. Once you get this, you will realise that many successful businesses already have it. It may be by design or may have been a result of organic development over time. Nonetheless, this can be quite handy for your sales team.

The low-cost PoC I mentioned earlier is part of stage-2 products and services. In terms of cost, it is more economical compared to the main product or service. At the same time, it helps prospective customers to fully visualise and appreciate your product's role in their own ecosystem.

Once they appreciate that and see the value in moving forward at full scale, your main product or service can take the centre stage. That is the stage-3 discussion. In my experience negotiations are more balanced if stage 2 has happened properly. Both sides understand each other better that way.

After the main product or service is in the works, complementary services and products make more sense. They provide more cross-sell opportunities that fit well with stage-3 offerings.

One of my mentors said to me once, "Knowing a point of breakthrough or being able to make it is critical for a sales consultant." And I think having a product ecosystem designed this way is the key to that breakthrough.

Free stuff

I'd say it upfront—not every company needs to offer free samples. You need to decide the merit of having the PoC in your product portfolio. But some products and services are way too costly, especially in the B2B scenario. Their free samples make little sense. There is hardly anything you can provide as free sample in such cases. However, thinking creatively and making something useful happen for your customers, at no cost to them, can still be valuable.

Especially for startups and small businesses, free samples can help achieve some breakthroughs in the early stages of their sales process. In the past, we have seen many design houses and semiconductor salespeople offer free development boards. Those boards were quite helpful in getting to understand their main product—the specific microcontroller or chipset they would sell.

Should you have a free sample or giveaway policy and product or service to offer? I am suggesting so, yes, but be careful about what you offer and how.

How product ecosystem can help

Free samples are good tools for building a customer base and driving the adoption of new products or services. However, be careful in considering the value and cost of such a free item. Ensure that it aligns with the overall goals and strategy of the business. The product ecosystem approach has several benefits, including the following:

Attracting price-sensitive customers. A low-cost product or service usually becomes an attractive option for price-sensitive customers. It doesn't have to be cheap though.

Building a customer base. Free samples, giveaways, and sometimes low-cost PoC help attract new customers and build a customer base. These introduce customers to your main products and services and encourage them to try your main offerings.

Achieving broader market reach. Sometimes, your main product or service can be limited to expanding market reach due to costs or the vastness of the offer. Stage 1 and stage 2 products allow you to expand that reach and target new market segments that may not be willing to pay full price without testing the products first.

Increasing customer loyalty. By providing a range of complementary products and services in stage 4, you can create a more complete and satisfying experience. That increases the likelihood of customers staying with you longer and doing more business with you, happily, as they see the value and range of your offers.

Increasing the number of revenue streams. When you have more products to offer, additional revenue sources open up. When more customers get attracted due to smoother entry into your product ecosystem, you end up creating additional value for everyone.

The point is, in my experience, the development of a product ecosystem has the power to be effective for startups to create a more complete and satisfying experience. To generate additional revenue streams and differentiate in the market, it is important to develop this ecosystem.

The first step to do that is to assess what you are offering today and where it fits in the four-stage product ecosystem explained here. From there, it is a straightforward journey—to develop things that are missing.

Now to the point about MVP. Gone are the days when minimum viability was an issue. In most cases, it is not anymore. Instead, let's give a new definition to MVP; let it be a minimum valuable product - a product that costs minimum but is still valuable to customers to place in their ecosystem without hesitation.

Think about this—'minimum viable' is your perspective, it focuses on you. But 'minimum valuable' is your customers' perspective, it focuses on them. And I know, you already know which perspective is better. Don't you? EFY

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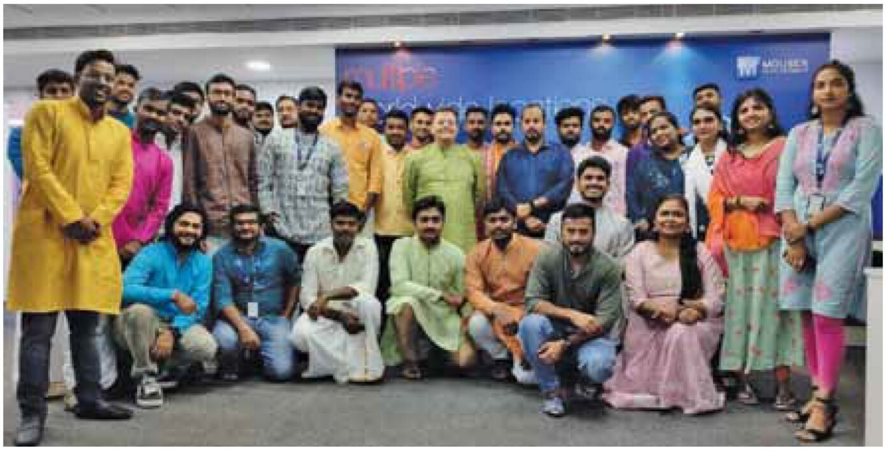
India

“The THROUGHPUT TIME For Us From The Time We Get An Order To The Time It’s Ready To Ship IS ABOUT 15 MINUTES”

Mouser.com has increased its revenue by two billion dollars in the last two years! What’s their success mantra? Why do customers keep going back to them? What are they investing in, to keep growing? Is India important for Mouser? Why? What’s next? Quite a few burning questions, which got answered when Yashasvini and Rahul from Electronics For You met Mark Burr-Lonnon, Senior Vice President of Global Sales and Service at Mouser Electronics, during his recent visit to India. Key extracts...

MARK BURR-LONNON
SENIOR VICE PRESIDENT OF GLOBAL SALES AND SERVICE, MOUSER ELECTRONICS



Congratulations to the Mouser India team who recently celebrated the APAC region's $1 billion sales milestone for 2022. Mark Burr-Lonnon joined the festivities by wearing a traditional kurta. It was a cherished moment for the India team to have Mark attend and recognise the region's substantial growth

How would you define Mouser's unique strength for its customers?

Our strength is in offering the newest products and working with small- to medium-sized customers to help them grow by getting the latest technology into the hands of the engineers who need them. We define New Products as those which are within 48 months from release to market, which is about 25% of our total inventory.

We also put a lot of time and effort to make sure we have the widest range of parts for all our suppliers. So, this is not about the value of inventory or depth of inventory, but the breadth of inventory. When engineers are looking for parts, they want to go to the one source where they have the optimum chance of finding as much as possible. Plus, we have a motto that says, "Always do the right thing."

Can you shed some more light on the motto and how you handle its execution?

Our order accuracy rate is very high, but there are times when our customers make mistakes or we make mistakes. We try to fix such mistakes. For example, if the customer has gotten something by mistake that can be returned/exchanged, then we'll send them the right part.

It's really important when you're dealing with a customer to do the right thing. If we look after someone, they come back. So, we do our best to do the right thing to help them come back.

How do you handle promotion of brands that sell competing stuff via your website?

We have some big suppliers and some small suppliers. When it comes to marketing, we do more with the big suppliers, because that's where most of the revenue comes from and they often have coop dollars that they want to use.

However, if we have a new technology, and it could be a very small supplier who may be supplying only four or five items, or it could be a supplier who we've just signed up, and they have a groundbreaking new technology—we promote it because it's something that engineers are interested in knowing about.

Do you list a product only when it's there in your warehouse, or is there an opportunity or a service for which you are also pre-booking orders?

We do take orders before the product comes into the warehouse. We won't promote it though.

The day the inventory hits the warehouse, the button goes off, and the marketing machine then starts to get into action. It is listed on the website and on the search engines. So, when someone's searching for it, they can immediately find it. There's nothing worse than a customer who gets excited about a new product but can't buy it. We promote it when we have it in stock.

We hear that there is some major expansion happening at Mouser. Can you shed some light on it?

We're building a new warehouse and doubling our warehouse capacity. Currently, we have about a million square feet of warehousing. This is a footprint of about 450,000 square feet, but it's going to be a mezzanine with three levels, totaling over a million square feet when finished. So that's going to double the components we can put in the warehouse.

In our business, inventory is king. Even during the past 12 months, we were fortunate to double our inventory and we plan to continue doing that. We currently have as much in the warehouse as we have on order. Despite the recent supply-chain issues, we have managed to increase a lot of inventory.

The one thing that drives our business more than anything else is inventory. We can't sell what we don't have. If we don't have the inventory, the marketing doesn't matter, because the marketing drives people to the inventory. If the inventory is not there, the marketing is a waste of time. So, we try to make sure that we have the inventory, only then we do the marketing.

Do you have any kind of robotic system, or any new innovation, that's coming or is already there in your warehouse?

In the current distribution centre, which we recently expanded, we have installed an "auto store." It has a huge number of robots picking and moving parts; and we're just beginning to see the benefits of that. We don't have any real data on that yet. As a corporation, we've had TTI in Germany which has an auto store in place, and that's working well for them. We've launched our auto store and filled it with products which are coming out now.

We've put a huge amount of money into vertical lift modules (VLMs). We currently have 138 vertical lift modules—more than any other company in the world. When we finish the new expansion, we'll probably double that. So, we'll be, by far, the largest user of VLMs. It's like a big filing cabinet, but it brings the inventory to the order pullers. The whole concept really is about trying to speed up the process of picking and the vertical lift modules are really good at doing that. We have all our fast-moving parts in there.

What's the benefit to your customers because of this level of automation?

The throughput time for us from the time we get an order to the time it's ready to ship is about 15 minutes! Sometimes it's so quick that some customers phone us half an hour later and say that they want to add another item to the order, and we have to tell them to place another order. Because it's easier to do that than to add to the earlier order, which has already been boxed and is ready to ship.

Is there any manual involvement in the entire warehousing operations?

Oh, yes—quality assurance and oversight. That's the key involvement; to see that everything is running smoothly. Plus, handling of smaller quantity orders. We ship even a single component to a customer, and handling of such small quantities is still manual. We have over 1,400 employees in the distribution centre.

What brings you to India? Is India doing better than expected, or does it need to do more to meet expectations?

We've got a large and growing team here. We have over 800 people in our Bangalore office. We have a back office doing lots of things for us corporately. We have a local sales team for India and our India business continues to grow strongly. I think we've got a good opportunity to grow it even more.

Do the team members move out of the office, or do they remain at office to support?

My team, which is the sales and customer service team, is primarily in the office. They're the customer service people. The manager goes to see some local customers to be sure where they need support.

Overall, we have 850 people in India. We have the local India team here, and then we have the bigger global team that's doing a fantastic job. There are also lots of product marketing people and web people who support our global organisation.

Remember, Mouser has grown in the last two years by $2 billion. We could not have done that without India. With what we have in place here now, we've done that, and hired people. Hiring is probably one of the biggest issues anywhere in the world. If we tried to do all that in Texas, we wouldn't be able to do it. The local presence here has really enabled our growth.

Growing $2 billion in two years is tough. It puts a lot of stress on a business, but I don't think our customers have really felt that - which is nice. Some days I wake up and wonder how we do it, but it's because of everybody working together. We couldn't have done it without the people in Bangalore, to be honest.

How do you estimate the potential of a market like India, or any other geography which does not have much data, to figure out the targets and performance?

We look at a couple of things, including the dollars that are coming in, because that's what pays the bills. The other thing that's important to us is the number of customers. With our broad product and supplier base, we do a lot of marketing activities to be sure that we get the right products in front of the right people.

We know what our customers are interested in, and we make sure that we send them relevant information—regardless of whether they're in an EMS, telecommunications, or computer company.

What is your next set of targets for India?

Well, when I look at the data, we've been very successful in South India. We've been less successful in West India. We think part of the reason is we don't have people in the place to do that. Hence, we have recently launched a new office in Pune. We think that many people in the West are probably more likely to use Pune than Bangalore. Pune is our office number two; we'll see how well it goes, before expanding further.

Plus, we are working on making it easier for our customers to pay in Indian currency. Hope to share that good news soon.

Can you clarify a little more about this—what's expected to change?

People can pay with a credit card now, but they can't pay in Indian rupees. We need to work through all the financial legalities, from a taxation standpoint. It's a time-consuming process but we are making progress. Stay tuned. Once complete, it will be good news for the customers in India. EFY

UNION BUDGET: Saptarishi For The Electronics Industry Too?

The Union Minister for Finance and Corporate Affairs, Nirmala Sitharaman, on way to Rashtrapati Bhavan and Parliament House, along with the Ministers of State for Finance, Pankaj Chaowdhary and Dr Bhagwat Kishanrao Karad, and some senior officials to present the Union Budget 2023-24

Key features of Budget 2023-24 announced by Finance Minister Nirmala Sitharaman on 1st February this year are highlighted below, along with the reactions from the industry

VAISHALI YADAV

Presenting the Union Budget this year, when Finance Minister Nirmala Sitharaman announced the adoption of Saptarishi (seven priorities) to guide India through the *Amrit Kaal*, all of the electronics industry was hoping for a helping hand too. And why not? The electronics and tech markets are still reeling under the Covid-19 pandemic-induced downfall.

Hence, the government's decision to eliminate import duty on the camera lens and components was taken in good stead, as it will benefit mobile phone manufacturers in India. Electronic Industries Association of India (ELCINA) believes that such exemption should be extended to all other electronic product segments that use camera modules and electronic components.

Highlights

But before going into the nitty-gritty of it, let's come back to square one and look at the major points of the Economic Survey and Union Budget 2023-24, with an eye on the Electronics System Design & Manufacturing (ESDM) sector:

- Globally, India is the 5th largest economy, and its per capita income has increased by over 2x in the last five years to ₹197,000.
- The domestic electronics industry, as of FY20, is valued at US$118 billion. India aims to reach US$300 billion worth of electronics manufacturing and US$ 120 billion in exports by FY26.
- The major drivers of growth in this industry are mobile phones, consumer electronics, and industrial electronics. India has become the second-largest mobile phone manufacturer globally, with the production of handsets going up from 60 million units in FY15 to 310 million units in FY22.
- ₹350 billion priority capital has been assigned for clean energy transition. The minister announced an outlay of ₹197 billion for the recently launched National Green Hydrogen Mission, with a target of 500MMT (million metric tonnes) of green hydrogen by 2030.
- Transportation and logistics received a major push with an

The announcement of three Centres of Artificial Intelligence and 100 labs for 5G apps to nurture R&D in India with the vision to Make AI in India and Make AI work for India will further strengthen India's position vis-à-vis global counterparts, said S. Durgaprasad, Co-founder, Director, and Group CEO of Bahwan CyberTek, a global provider of digital transformation solutions.

TABLE 1
CUSTOM DUTY ANNOUNCEMENTS FOR ESDM SECTOR

Item	Exist. BCD (%)	Updated BCD (%)	Notif./Finance Bill Clause
Camera lens for camera module and Input/sub parts for lens of camera module (mobile phone)	2.5	Nil	Notification No. 6/2023, Serial No. 3
Parts for manufacture of open cells of TV panels	5.0	Nil	Notification No. 2/2023, Serial No. 33
Capital goods and machinery required for manufacture of lithium-ion cells for batteries used in electric vehicles	7.5	Nil	Notification No. 6/2023, Serial No. 2
Palladium Tetra Amine Sulphate for manufacture of parts of connectors	7.5	Nil	Notification No. 6/2023, Serial No. 1
Specified chemicals/items for manufacture of Pre-calcined Ferrite Powder	7.5	Nil	Notification No. 6/2023, Serial No. 17

(Courtesy: ICEA)

As per Jyoti Pal, Associate Partner at Lakshmikumaran & Sridharan, "Some changes have been made in Tariff Heading 8524 of the Customs Tariff Act. Separate tariff items have been added for flat panel display modules for certain categories of ADPM (Computers), mobile phones, television sets/ LCDs, and residual categories for others. Tariff Heading 8517 has also been amended."

outlay of ₹2,400 billion for railways and announcements for 50 additional airports, helipads, water aero drones, etc.

- Pushing for a reduced digital divide, labs for 5G applications, classrooms, precision farming, and healthcare applications will be set up, and the scope of Digilocker will be expanded.
- Receiving a significant fillip after the lockdown, phase 3 of E-courts projects is to be launched with an outlay of ₹70 billion.
- This year, three Centres of Excellence for AI, and other advanced emerging technologies will be set up.
- The Budget also touched upon the aspect of skill development in Industry 4.0, robotics, drones, and related industries.
- The government reduced the basic customs duty (BCD) on certain parts, such as camera lenses, while concessional duty will continue on lithium-ion cells for another year.
- Agriculture Accelerator fund to be set up for encouraging innovative startups to bring affordable rural ideas to fruition.

Changes to be noted

- Substitution/Amendment in Tariff Heading 8517–Information Technology Agreement, 1996–motivated in Supporting Manufacturing of Electronics.
- Expansion in the scope of Tariff Heading 8524: Separate tariff items have been added for flat panel display modules for certain categories of ADPM, mobile phones, television sets/LCDs, and residual categories for others.
- The scope of exemption expanded to include capital goods used for manufacturing the batteries for electrically operated vehicles.
- Reduction in the customs duty rate on components used in the manufacture of open cell of TV panels.
- Reduction in effective customs duty on the camera lens and sub-parts/inputs used in the manufacture of mobile phone camera modules.

Positive steps

The industry associations have welcomed the following steps announced in the Budget:

1. Removal of duty of camera lens of 2.75%
2. Removal of duty on inputs to parts of connectors—palladium tetra amine sulphate
3. Reduction of BCD on parts of the open cell of the TV panel from 5.5% to 2.75% (including SWS)
4. Continuation of customs exemption notifications, which were facing the sunset on the 31st of March 2023, for another year
5. Customs duty exemption for the import of machinery required for the manufacture of lithium-ion cells for batteries used in EVs
6. Reduction of BCD on specific parts used in the manufacturing of television sets to 2.5%
7. Reclassification in HS Codes 8517 and 8524 for flat panel display inputs
8. Relief on customs duty on import of certain parts used in the manufacturing of mobile phones
9. Rectification of inverted duty structure to encourage manufacturing of electric kitchen chimneys

Gaps

Notwithstanding the beneficial steps announced on February 1, the Budget left many long-standing demands unfulfilled, despite repeated requests put up by industry bodies and individual companies.

According to the Chairman of India Cellular & Electronics Association, Pankaj Mohindroo, "A high-performing sector's genuine requests have not been addressed. These could have provided a significant impact on competitiveness leading to better exports, arresting the grey market and boosting revenue." He pointed out the below-mentioned issues:

1. Capping of BCD on import of

Pratik Kamdar, Co-founder of Neuron Energy, a player in the battery industry remarked: "The Customs Duty exemption on capital goods and machinery to manufacture lithium-ion will be a facilitator for the country to transition to sustainable and eco-friendly mobility. The exemption will have a domino effect on the overall sector with the over substantial decrease in the overall cost of the finished products, wherein the battery packs are likely to reduce by 5% coupled with lower initial investments. Additionally, the vehicle scrapping policy will also be beneficial if the old vehicles are replaced by electric vehicles. This will further aid in the country's vision of mass EV adoption by 2030."

high-end mobile phones could have arrested the burgeoning smuggled market, which has crossed ₹120 billion, in 2023. This measure would have boosted government revenue, reduced smuggling, ensured fair trade, and helped build legal businesses in India.

2. Removal of input duties on Resin, Mesh, Sponge, Film, Gasket, Logo, Cover Tape, and Adhesive Tape from 8.25% - 16.5% to zero level was essential to promote the manufacturing of a very critical vertical—Mechanics. But the Budget didn't provide the needed relief in this direction.

3. Input duties of 2.75%, the duty imposed in the previous Budget on the many inputs of PCBA, inputs of connector, and inputs of camera module were not removed.

4. Removal of duty on certain parts of the chargers would have provided the huge charger manufacturing industry with a competitive edge.

TABLE 2

8524: FLAT PANEL DISPLAY MODULES, WHETHER OR NOT INCORPORATING TOUCH-SENSITIVE SCREENS

S. No.	Previous HSC	Description	Revised HS Lines (Finance Bill 2023)	Description
1	8524 11 00	Of Liquid Crystal	8524 11 10	For the goods of sub-heading 8471 30 or 8471 41
			8524 11 20	For the goods of sub-heading 8517 13 or 8517 14
			8524 11 30	For the goods of sub-heading 8528 72 or 8528 73
			8524 11 90	Other
2	8524 12 00	Of organic light-emitting diodes (OLED)	8524 12 10	For the goods of sub-heading 8471 30 or 8471 41
			8524 12 20	For the goods of sub-heading 8517 13 or 8517 14
			8524 12 30	For the goods of sub-heading 8528 72 or 8528 73
			8524 12 90	Other
3	8524 19 00	Other	8524 19 10	For the goods of sub-heading 8471 30 or 8471 41
			8524 19 20	For the goods of sub-heading 8517 13 or 8517 14
			8524 19 30	For the goods of sub-heading 8528 72 or 8528 73
			8524 19 90	Other
4	8524 91 00	Of liquid crystals	8524 91 10	For the goods of sub-heading 8471 30 or 8471 41
			8524 91 20	For the goods of sub-heading 8517 13 or 8517 14
			8524 91 30	For the goods of sub-heading 8528 72 or 8528 73
			8524 91 90	Other
5	8524 92 00	Of organic light-emitting diodes (OLED)	8524 92 10	For the goods of sub-heading 8471 30 or 8471 41
			8524 92 20	For the goods of sub-heading 8517 13 or 8517 14
			8524 92 30	For the goods of sub-heading 8528 72 or 8528 73
			8524 92 90	Other
6	8524 99 00	Other	8524 99 10	For the goods of sub-heading 8471 30 or 8471 41
			8524 99 20	For the goods of sub-heading 8517 13 or 8517 14
			8524 99 30	For the goods of sub-heading 8528 72 or 8528 73
			8524 99 90	Other

(Courtesy: ICEA)

5. The 50% increase in GST from 12% to 18% has dealt a very cruel hand to this high-performing industry, which kept the nation's economy moving during the Covid pandemic.

ICEA opined that while the industry had met the 2021-22 manufacturing target of ₹2,750 billion, we will fall short of the manufacturing target of FY 2022-23 because of domestic demand shrinking in 2022-23. Mohindroo added that, competitiveness is the key to both buoyant domestic demand and export.

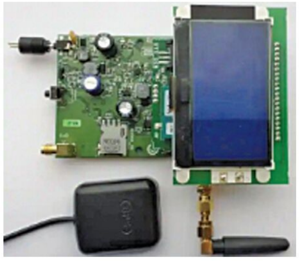
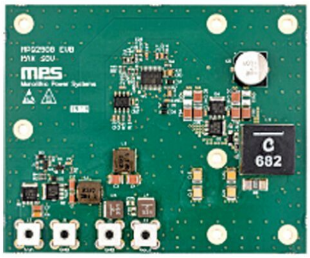
The Secretary General at ELCINA, Rajoo Goel, noted the Finance Minister's announcement to reduce customs duty on parts of open cell of TV panels to 2.5% from 5% earlier. "All this will create demand for electronics hardware and create jobs as well in the electronics industry. The Finance Minister has laid a lot of emphasis on skill development for green energy products, drones, robotics, and IoT. All these are positive developments for the electronics sector," commented Goel.

In a post-Budget session conducted by ELCINA, long-term and enhanced support for components manufacturing under PLI and the Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors (SPECS) was recommended. The association also stated that the EMS sector must be included under the SPECS scheme to provide subsidies against capital investments, as it will hopefully give the required thrust to value addition and boost electronics manufacturing in all segments.

Some industry players suggested bringing Service Linked Incentive Schemes, on the lines of Production Linked Incentive (PLI) Schemes, to improve the workflow. Going forward, deeper digital and Internet of Things (IoT) penetration and the ever-increasing impetus on smart cities and robotics will boost the industrial and automated electronics sector in Industry 4.0. Also, the PLI scheme is expected to assist more domestic players to achieve economies of scale in production through localising. In turn, it will magnify India's role in the global value chain and enhance export competitiveness. What remains to be seen, though, is the effective implementation of the initiatives announced for India's Amrit Kaal. EFY

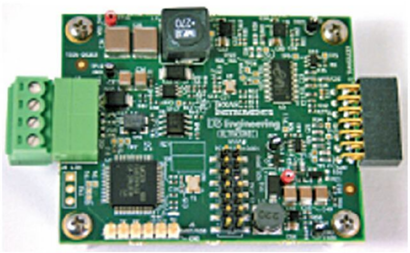
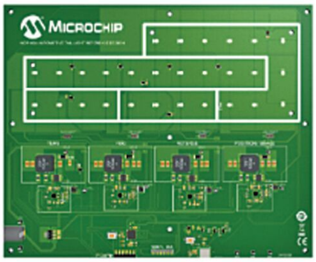
Vaishali Yadav, a journalist at EFY, muses upon clouds, security, sustainability, integration, smartness, machines and learning—both trivially and technologically

5 Interesting REFERENCE DESIGNS

Title of Reference Design	Reference Design For Smart Real-Time Vehicle Tracking System	Reference Design For 48V Buck Converter For Automotive Systems
Image		
Key Attraction	This reference design is for a smart vehicle tracking system based on GPS/GSM/GPRS. The reference design can predict accidents and car burglaries and share multiple data—such as location, speed, time, etc—over GPRS to the web server application.	This reference design is a high-voltage, synchronous, step-down controller that directly steps down voltages from up to 60V. The reference design can take an input from 4V to 60V and provide a constant output of 12V. It has a programmable soft start and multiple other safety features.
Highlights	The STEVAL-IEG001V2 from STMicroelectronics is a smart vehicle tracking system reference design. The reference design allows developers to easily create a GPS/GSM/GPRS based vehicle tracking system by providing a complete hardware and software solution with a clear and easy-to-use interface. It is powered by the STM32F401RE microcontroller, a powerful 32-bit Arm Cortex-M4 microcontroller. The reference design also includes a GSM/GPRS modem and GPS receiver, as well as a range of other interfaces and peripherals for connectivity and positioning. This unit features a 3-axis accelerometer and yaw/pitch/roll gyroscope L3GD20, which enables it to sense car lift using the MEMS. It can also predict vehicle theft by analysing the MEMS data. It can store the vehicle's status and location parameters in the microSD card and share the information to the admin by text message, thereby implementing black box functionality. The system consists of a vehicle unit (installed inside the vehicle) and remote web server application where the vehicle status and movement data can be viewed in an intuitive way on the map.	The MPQ2908 from Monolithic Power is a 48V to 12V buck converter capable of delivering 15A current and complying with CISPR-25 Class 5 EMC standards. The automotive buck converter has an efficiency of up to 95%. It employs a dual n-channel MOSFET driver. The reference design is AEC-Q100 qualified and has a wide 4V to 60V operating input range. It offers a programmable frequency range of 100kHz to 1000kHz, which can be programmed by an external resistor or synchronised to an external clock for noise-sensitive applications. The DC/DC converter has a programmable soft start and offers safety features, including output over-voltage protection (OVP), over-current protection (OCP), external input over-voltage protection (OVP), and external reverse-polarity protection (RPP). The SMPS also has a power good (PG) output voltage monitor and selectable cycle-by-cycle current limit that can improve the reliability of the connected devices.
Application	This reference design can be used for a wide range of vehicle tracking and fleet management applications. Moreover, it can predict crash and theft using the MEMS sensor.	This reference design is suitable for use in automotive power systems and industrial systems.
OEM Brand	STMicroelectronics	Monolithic Power Systems
URL	https://www.electronicsforu.com/electronics-projects/electronics-design-guides/reference-design-for-a-smart-real-time-vehicle-tracking-system	https://www.electronicsforu.com/electronics-projects/electronics-design-guides/reference-design-48v-buck-converter-for-automotive-systems

For Automotives

The author, Sharad Bhowmick, works as a Technology Journalist at EFY. He is passionate about power electronics and energy storage technologies. He wants to help achieve the goal of a carbon neutral world

Reference Design For Automotive Ultrasonic Fluid Level Monitor	Reference Design For Automotive BMS	Reference Design For Automotive Tail Light
		
This reference design for an automotive ultrasonic fluid level monitor employs a non-intrusive technique to accurately measure the liquid even in harsh/enclosed environments. The refence design is a cost-effective solution with an external temperature sensor to mitigate error in measurement.	This reference design for a battery management system is suitable for high-voltage automotive batteries. It offers high accuracy and long-term drift (LTD), which can extend driving range and battery life performance.	This is reference design for an automotive LED tail light driver that can be controlled either directly in standalone mode or from a phone, tablet, or other mobile devices by using an Android application.
TIDA-00322 is a reference design for an automotive ultrasonic fluid level/quality measurement. It can run on a wide range of voltages of 4.5V to 40V and offers reverse battery protection. It provides a user-friendly interface and can be easily configured and calibrated to suit the specific needs of the application. It features a high voltage circuit to drive the transducer with 30V to penetrate deeper tanks, making it suitable for larger vehicle tanks and containers. This reference design utilises ultrasonic sensors to measure the level and quality of fluids in automotive systems, such as engine oil, transmission oil, and coolant. TIDA-00322 also features an external resistance temperature detector (RTD) to monitor temperature changes that affect the medium's speed of sound, therefore negating any measurement error due change in temperature. The reference design is based on the Texas Instruments' TMS470R1B1M microcontroller and ultrasonic transducers. The design can be used to detect and measure low fluid levels, detect air bubbles in the fluid, and measure the fluid quality by measuring the fluid dielectric constant.	The BMS reference design from Renesas is an automotive-grade multi-cell Li-ion battery management system. It can support up to 70 series-connected Li-ion cells, which makes it suitable for high voltage (HV) battery packs used in EVs. The reference design employs a ASIL D rated RH850 microcontroller that communicates with the ISL78714 multi-cell Li-ion battery manager devices to monitor cell voltage, pack temperature and current, record significant fault detection, and control cell balance. This BMS reference design can be daisy-chained to connect multiple modules to support bigger batteries. It contains daisy chain hardware to provide robust, isolated communication between batteries. In a typical configuration, a Master ISL78714 communicates to a host microcontroller through an SPI port and up to 29 additional ISL78714 devices connected together by a robust, proprietary, two-wire daisy chain. This communication system is highly flexible and can be implemented with capacitor isolation, transformer isolation, or a combination of both. The reference design offers intelligent power device (IPD) for external load control and is suitable for use in harsh automotive conditions.	Microchip's MCP1633 is a standalone LED driver controller for automotive tail-light with Bluetooth connectivity. The reference design is a DC/DC converter that provides a compact and efficient solution for taillight applications in vehicles. The design features a low quiescent current and high efficiency. It offers adjustable output voltage to show different conditions, such as braking, reversing, and turning. The automotive LED taillight driver can be controlled either directly in standalone mode or from a phone, tablet, or other mobile devices by using an Android application. The reference design can take input voltage from 8V to 16V with a surge voltage of up to 42V. MCP1633 features a Microchip's MCP1633 high-speed pulse-width modulator (PWM), which is used to control the switching. To speed up the design, a factory-programmed source code is provided by the company but additional functionality can be added by modifying the source code. The reference design offers multiple protection features, including configurable undervoltage lock-out circuit software, overvoltage protection, etc.
This reference design can be used in a wide range of automotive applications, such as to monitor oil/coolant level, quality and any trapped bubble in the fluid.	This BMS reference design is suitable for use in hybrid electric vehicles (HEV), electric vehicles (EV), electric motorcycle battery packs, energy storage battery packs, etc.	The LED driver controller for automotive tail-light is suitable for use in almost all types of vehicles.
Texas Instruments	Renesas	Microchip
https://www.electronicsforu.com/electronics-projects/electronics-design-guides/reference-design-for-an-automotive-ultrasonic-fluid-level-monitor	https://www.electronicsforu.com/electronics-projects/electronics-design-guides/reference-design-for-an-automotive-bms	https://www.electronicsforu.com/electronics-projects/electronics-design-guides/reference-design-for-an-automotive-tail-light

EFY TESTED
Ashwini K. Sinha

How To Convert ChatGPT Into An ADVANCED VOICE ASSISTANT

ChatGPT-3 needs no introduction. You ask it any question and it replies in a flash. But the answer comes in the form of text. What if you could talk with it, just like you do with any voice assistant like Siri?

ASHWINI KUMAR SINHA

Hello
What can can i help you ?
Hello
I need help

It's no secret that ChatGPT has revolutionised the world of AI. Unlike other AI bots, it is able to understand the context of a conversation and respond, and it makes you feel like you are chatting with a human and not a machine.

But as it is still a kind of chatbot, you need to type a question and you get the answer in the form of text. That's not as exciting as talking to a bot.

This thought gave me the idea of programming ChatGPT so that it could be used as a voice assistant called VoiceGPT. I began by using natural language processing (NLP) to recognise the voice, and then transferring the recognised voice to the ChatGPT engine as a query using the API. After getting an intelligent reply from ChatGPT, I again used NLP to convert it into a human voice.

I needed a good NLP tool for this and OpenAI itself provides one, that is, Whisper. But due to limited time and space, I ended up using Google Natural Language API.

A step-by-step guide to making VoiceGPT

We need to begin by combining the NLP for the ttX service with ChatGPT. For this we need a machine to run the open API, transfer the query

“I started reading it when I was a student…
…and I am still reading it, as a student”

—CEO, Design House

India's No.1 Electronics Magazine
RANKING AS PER ELCINA-IMRB REPORT

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YOURS SINCE 1969

AI AND ROBOTICS SPECIAL
electronics
ARTIFICIAL INTELLIGENCE
Hype Or Reality?
Can Video Games Improve Brain Functioning?
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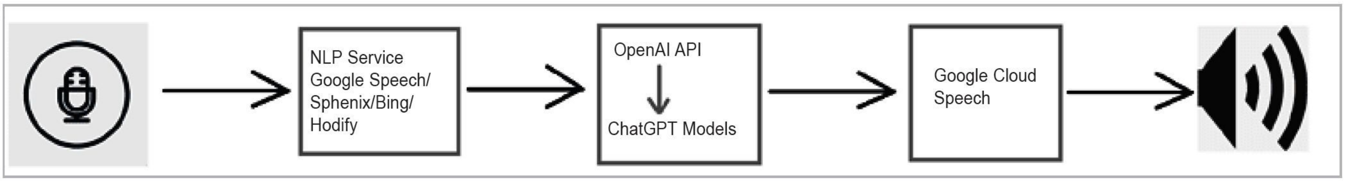

NLP Service Google Speech/ Sphenix/Bing/ Hodify
OpenAI API
ChatGPT Models
Google Cloud Speech

Fig. 1: VoiceGPT working principle

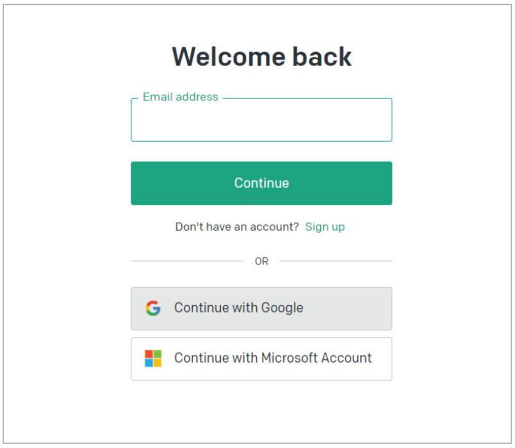
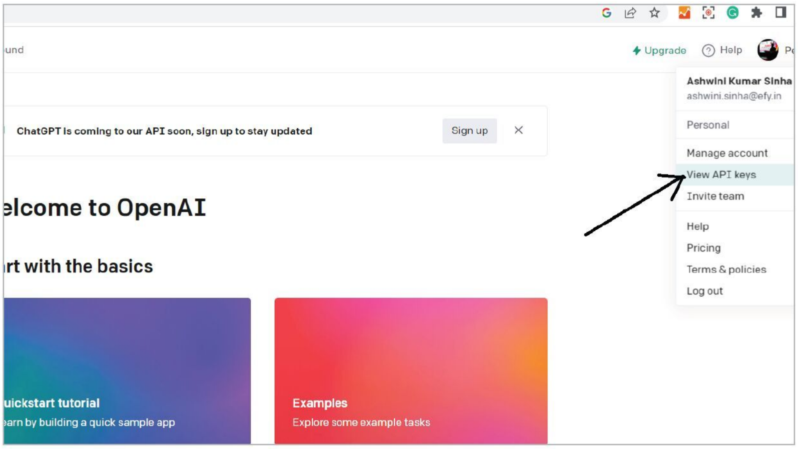
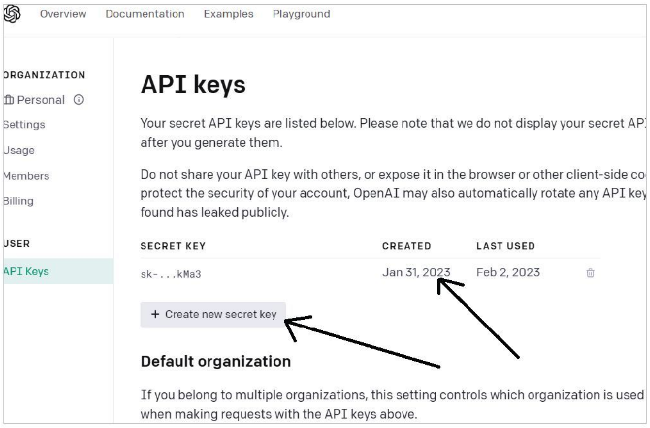

Welcome back
Email address
Continue
Don't have an account? Sign up
OR
Continue with Google
Continue with Microsoft Account

Fig. 2: ChatGPT login page


und
Upgrade
Help
Pe
Ashwini Kumar Sinha
ashwini.sinha@efy.in
Personal
Manage account
View API keys
Invite team
Help
Pricing
Terms & policies
Log out
Sign up
elcome to OpenAI
rt with the basics
uickstart tutorial
earn by building a quick sample app
Examples
Explore some example tasks

ChatGPT is coming to our API soon, sign up to stay updated

Fig. 3: Getting the OpenAI API menu


Overview
Documentation
Examples
Playground
ORGANIZATION
Personal
Settings
Usage
Members
Billing
USER
API Keys
Create new secret key

API keys

Your secret API keys are listed below. Please note that we do not display your secret API after you generate them.

Do not share your API key with others, or expose it in the browser or other client-side co protect the security of your account, OpenAI may also automatically rotate any API key found has leaked publicly.

SECRET KEY	CREATED	LAST USED
sk-...kMa3	Jan 31, 2023	Feb 2, 2023

Default organization

If you belong to multiple organizations, this setting controls which organization is used when making requests with the API keys above.

Fig. 4: ChatGPT API keys

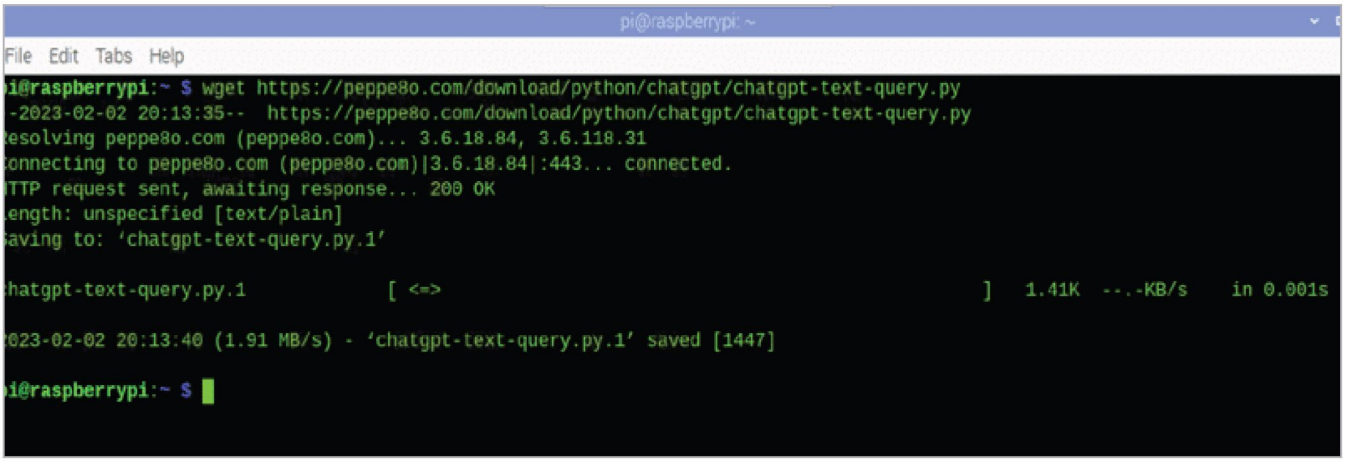
gathered from NLP, and reprocess the answer given by ChatGPT into a human voice using NLP.

You can use any laptop, but I chose the Raspberry Pi to run all this. For capturing the voice for recognition, I attached the voice bonnet; a USB microphone can also be used with Raspberry Pi. However, if you are using a laptop to run the VoiceGPT code, there is no need for a USB microphone; you can use the laptop's inbuilt microphone.

We now need to create an account and log into ChatGPT (see Fig. 2).

Next, we need to get the API key for doing research and experimenting with the ChatGPT code, as shown in Fig. 3.

You can create the API key using the right-corner option for API in


pi@raspberrypi: ~
File Edit Tabs Help

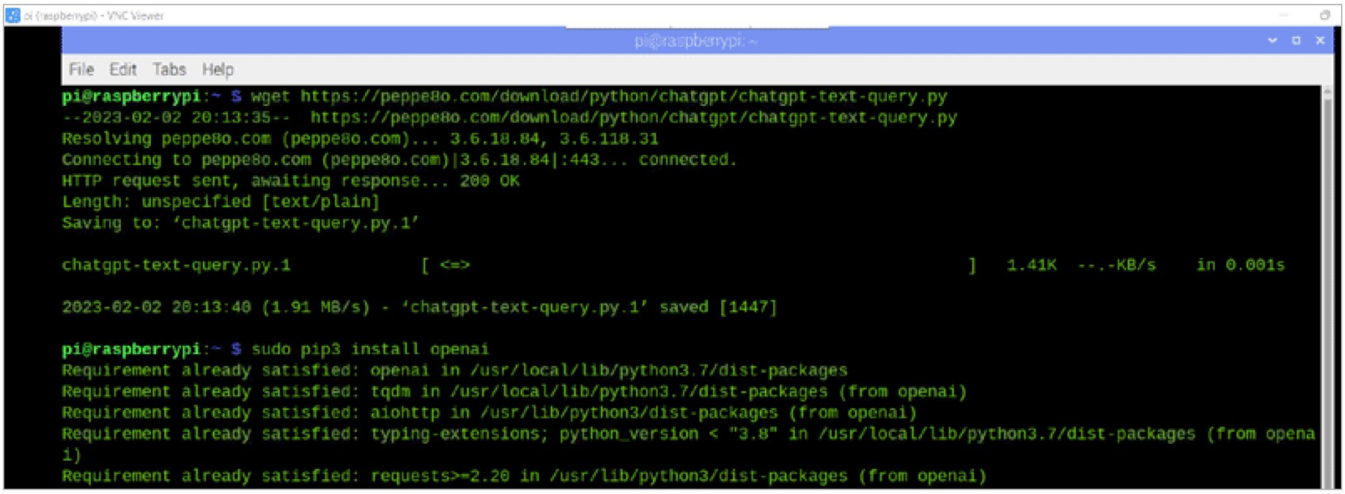
```
i@raspberrypi:~ $ wget https://peppe8o.com/download/python/chatgpt/chatgpt-text-query.py
-2023-02-02 20:13:35--  https://peppe8o.com/download/python/chatgpt/chatgpt-text-query.py
esolving peppe8o.com (peppe8o.com)... 3.6.18.84, 3.6.118.31
onnecting to peppe8o.com (peppe8o.com)|3.6.18.84|:443... connected.
TTP request sent, awaiting response... 200 OK
ength: unspecified [text/plain]
aving to: ‘chatgpt-text-query.py.1’

hatgpt-text-query.py.1          [ <=>                                        ]   1.41K  --.-KB/s    in 0.001s

023-02-02 20:13:40 (1.91 MB/s) - ‘chatgpt-text-query.py.1’ saved [1447]

i@raspberrypi:~ $ 
```

Fig. 5: Cloning OpenAi ChatGPT code



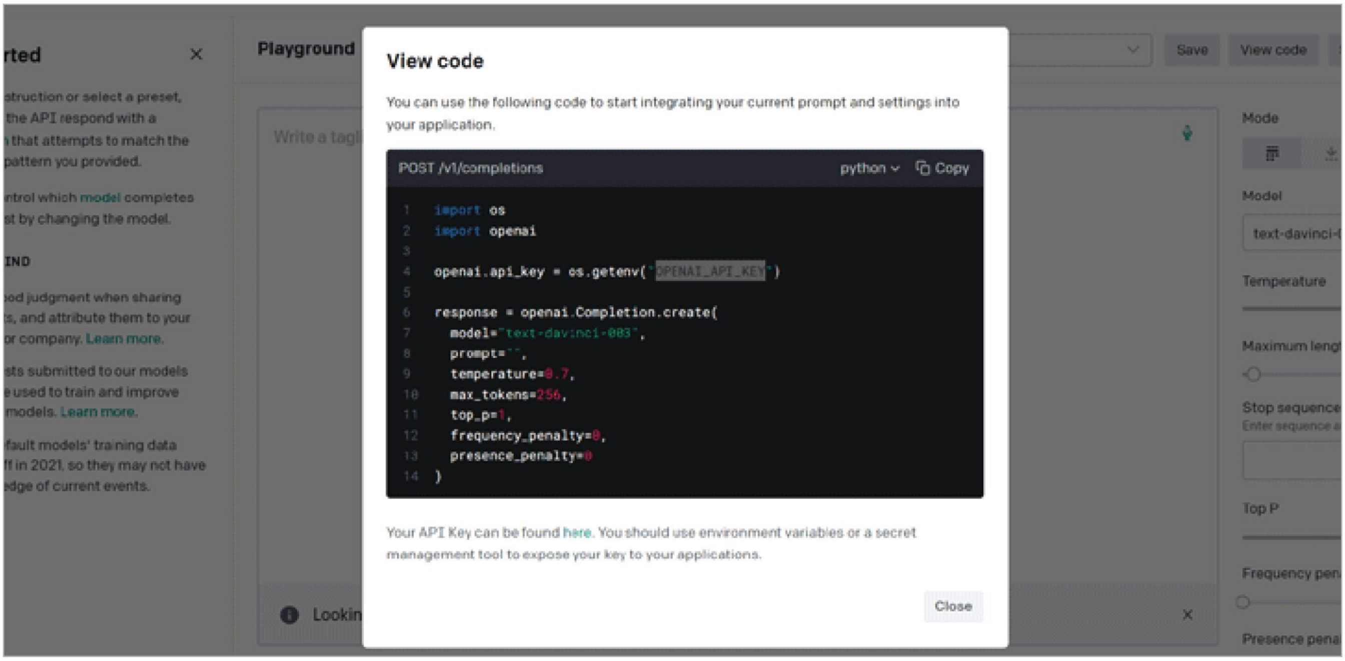
```
pi@raspberrypi:~ $ wget https://peppe8o.com/download/python/chatgpt/chatgpt-text-query.py
--2023-02-02 20:13:35--  https://peppe8o.com/download/python/chatgpt/chatgpt-text-query.py
Resolving peppe8o.com (peppe8o.com)... 3.6.18.84, 3.6.118.31
Connecting to peppe8o.com (peppe8o.com)|3.6.18.84|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: unspecified [text/plain]
Saving to: ‘chatgpt-text-query.py.1’

chatgpt-text-query.py.1            [ <=>                                              ]   1.41K  --.-KB/s    in 0.001s

2023-02-02 20:13:40 (1.91 MB/s) - ‘chatgpt-text-query.py.1’ saved [1447]

pi@raspberrypi:~ $ sudo pip3 install openai
Requirement already satisfied: openai in /usr/local/lib/python3.7/dist-packages
Requirement already satisfied: tqdm in /usr/local/lib/python3.7/dist-packages (from openai)
Requirement already satisfied: aiohttp in /usr/lib/python3/dist-packages (from openai)
Requirement already satisfied: typing-extensions; python_version < "3.8" in /usr/local/lib/python3.7/dist-packages (from opena
i)
Requirement already satisfied: requests>=2.20 in /usr/lib/python3/dist-packages (from openai)
```

Fig. 6: Raspberry Pi ChatGPT setup



View code

You can use the following code to start integrating your current prompt and settings into your application.

POST /v1/completions — python — Copy

```python
import os
import openai

openai.api_key = os.getenv("OPENAI_API_KEY")

response = openai.Completion.create(
  model="text-davinci-003",
  prompt="",
  temperature=0.7,
  max_tokens=256,
  top_p=1,
  frequency_penalty=0,
  presence_penalty=0
)
```

Your API Key can be found here. You should use environment variables or a secret management tool to expose your key to your applications.

Close

Fig. 7: Setting temperature, frequency, and chat model in ChatGPT

your OpenAI account (Fig. 4).

After generating the OpenAI API key, copy it and save it. We need it later in our code for developing VoiceGPT.

Now we need to install the open AI on the system where we are going to run the VoiceGPT. Here you can use a computer with any Linux version installed. I used Raspberry Pi for it.

Next, open the terminal and install the open AI and other Python modules that help us in natural language processing. Here you can use Whisper from OpenAI or any other NLP module. I used Google NLP and combined it with ChatGPT.

You can install these modules using the following command. After that, you can either create your open custom talking content in OpenAI or use simple chatting in the playground. Here, you can also set the temperature, frequency, and other parameters for your VoiceGPT assistant.

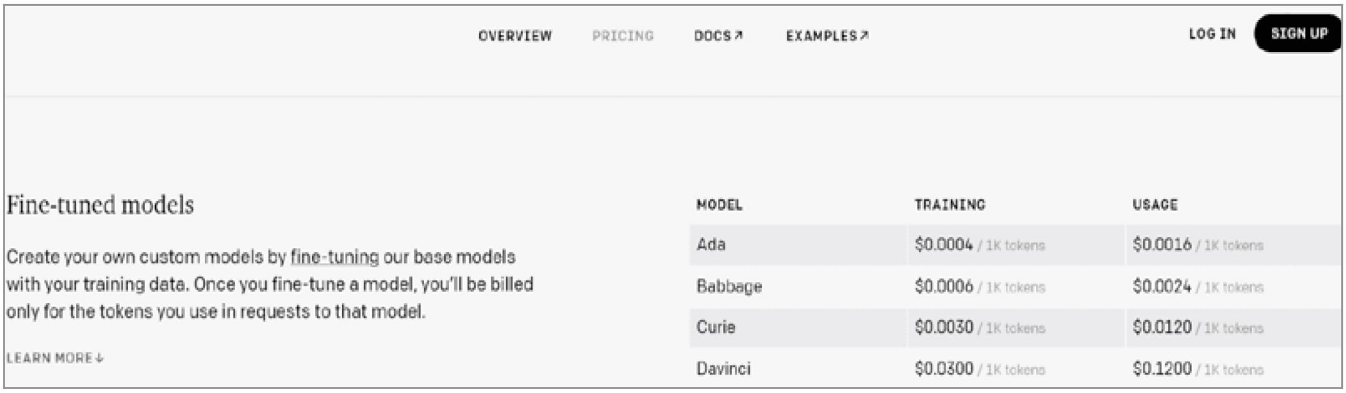
```
sudo pip3 install openai
sudo pip3 install SpeechRecognition
sudo pip3 install gTTS
```

Refer to Fig. 5 and Fig. 6 to see how to clone the OpenAI ChatGPT and do the setup.

Next, set the temperature, frequency, and chat model, as shown in Fig. 7.

Programming ChatGPT to be used as VoiceGPT

First, we need to import the OpenAI Python module in code to play with



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MODEL	TRAINING	USAGE
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Babbage	$0.0006 / 1K tokens	$0.0024 / 1K tokens
Curie	$0.0030 / 1K tokens	$0.0120 / 1K tokens
Davinci	$0.0300 / 1K tokens	$0.1200 / 1K tokens

Fig. 8: List of ChatGPT models

OpenAI and carry out an experiment with ChatGPT. Next, we import the modules for NLP. After that, we import *pygame* to play the file that processed the reply in a human voice using the NLP model.

Next, we need to set the ChatGPT model (see Fig. 8). Here, we can choose from model names like Davinci, Ada, etc. Each model has its own expertise, and the cost of using these models varies. But no worries, because developers get a US$18 credit to develop and experiment with OpenAI.

Next, we need to set the API in the code. With that, we have created the function for connecting with ChatGPT to handle the query and get the response from it.

```
import speech_recognition as sr
import math
import time
import serial
from espeak import espeak
import sys
import openai
import pygame
from gtts import gTTS
pygame.mixer.init()
#model_to_use=”text-davinci-003” # most
capable
#model_to_use=”text-curie-001”
#model_to_use=”text-babbage-001”
model_to_use=”text-ada-001” # lowest
token cost
r = sr.Recognizer()
openai.api_key=”******Your Key
Here*******”
```

```
def chatGPT(query):
   response = openai. Completion.create(
            model-model_to_use,
            prompt=query,
            temperature=0,
            max_tokens 1000
            )
return str.strip(response[‘choices’][0]
[‘text’]), response[‘usage’][‘total_
tokens’]
```

After that, we create the main function and then make a *while* loop. Here, we use NLP to capture the voice continuously and extract what we said using the NLP model and save it as a query. Then we transfer this query to ChatGPT and receive the response from it.

```
def main():
  print(‘LED is ON while button is
  pressed (Ctrl-C for exit).’)
  while True:
  with sr.Microphone() as source:
  r.adjust_for_ambient_noise (source)
  print(“Say something!”)
  audio r.listen(source)
  print(“Recognizing Now....”)
  command=str(r.recognize_google (audio))
  print(“Google Speech Recognition thinks
  you said + command)
  query=command
  (res, usage) = chatGPT (query)
  print(res)
  tts gTTS(text=res, lang=’en’)
  tts.save(“good.mp3”)
  pygame.mixer.music.load(“good.mp3”)
  pygame.mixer.music.play()
  #espeak.synth(res)
```

```
if __name__ ==  ‘__main__’:
main()
```

After this, we again use NLP to convert the reply from ChatGPT into a human voice, and then we play that voice. This whole thing runs in a loop continuously making it look like a real conversation between two humans.

This VoiceGPT gives you the option of customising and selecting models. It allows you to choose from GPT models like Ada, Davinci, or Babbage. It uses a free speech-recognition service that can be customised to offline speech-recognition services like Sphenix.

Testing VoiceGPT

To test the VoiceGPT, run the code in Python, and it will tell you to ask a question or start a conversation. You can ask whatever you want; it recognises your voice, transfers the query to ChatGPT, and then replies to you in a human voice.

So now you can talk to ChatGPT just like you do with Google Assistant, Alexa, or Siri. Enjoy your conversation with VoiceGPT! EFY

Author's note. This is the first version of VoiceGPT. I am still experimenting with it and you will get all the new updates very soon on *https://www.opensourceforu.com.*

Ashwini Kumar Sinha is an IoT and
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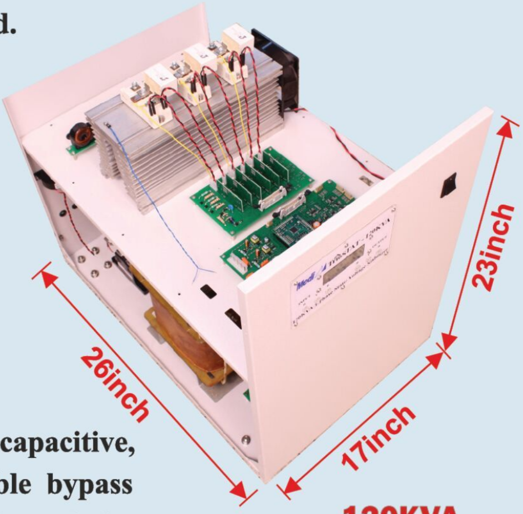

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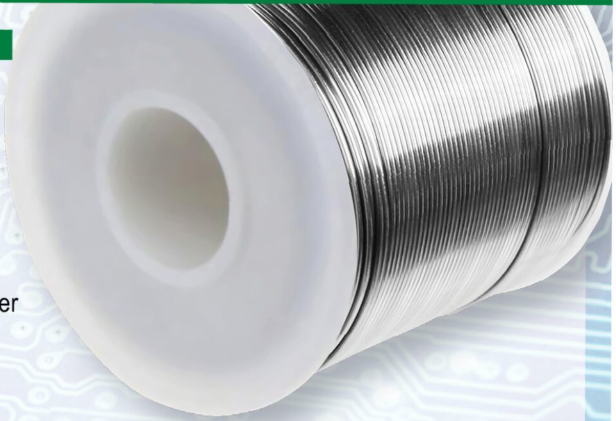

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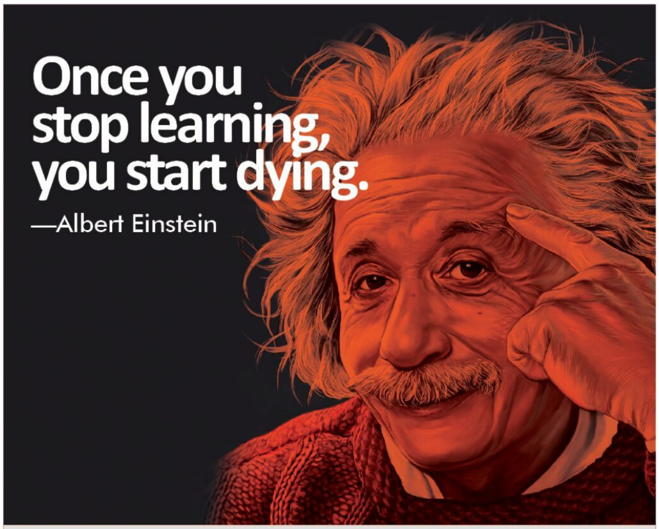
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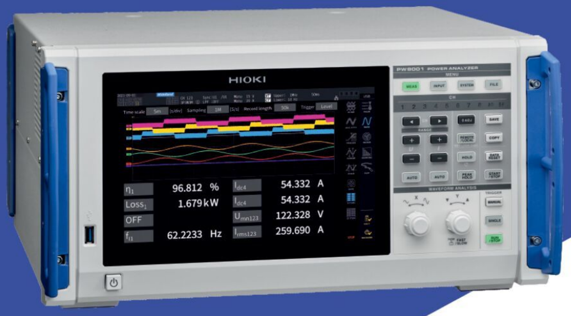
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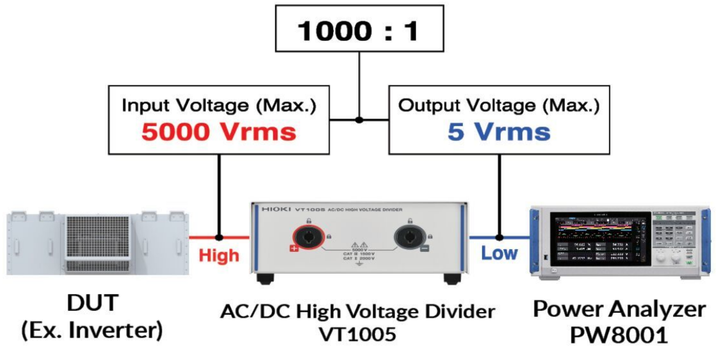
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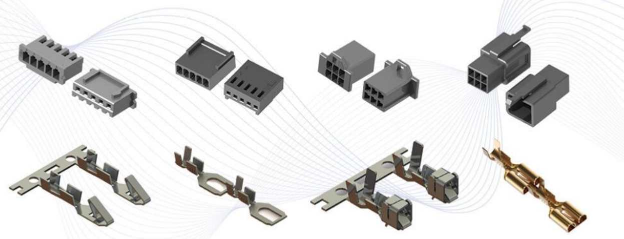

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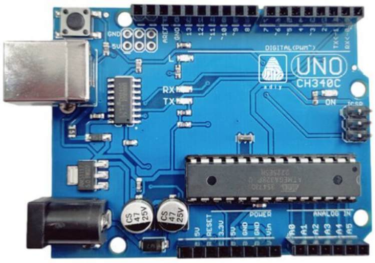

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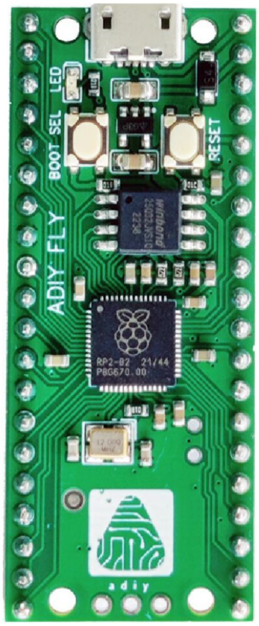

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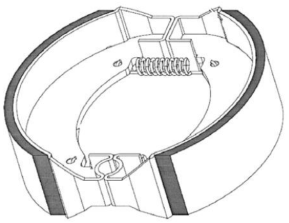

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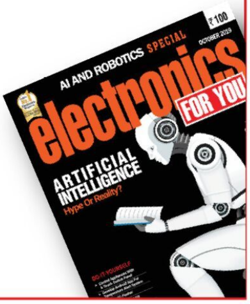
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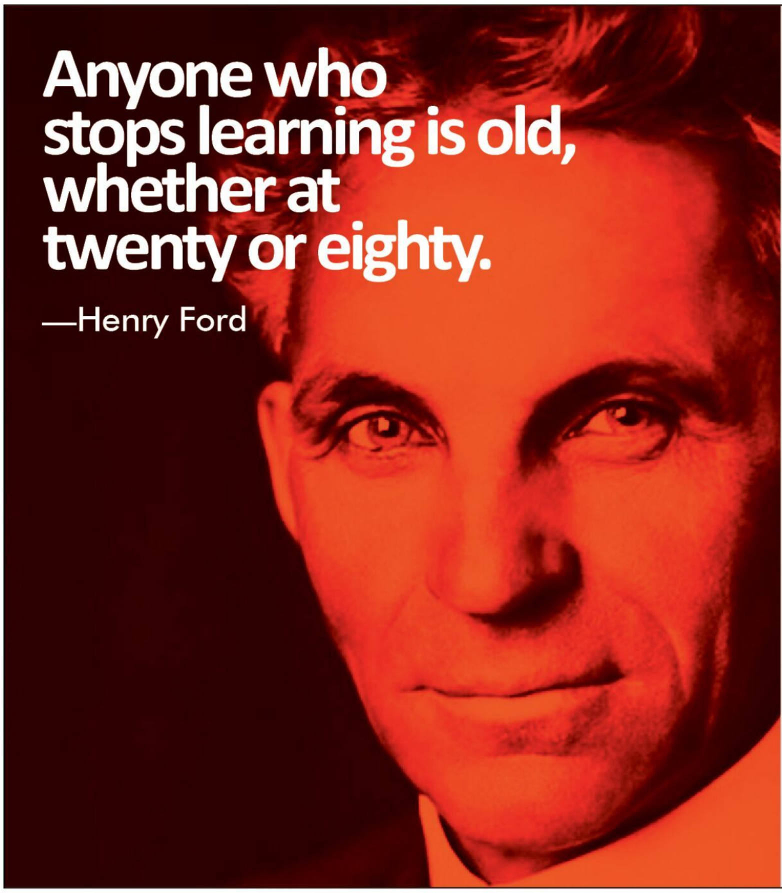
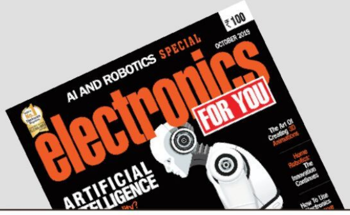
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Statement about ownership and other particulars about

ELECTRONICS FOR YOU

FORM IV (See Rule 8)

1. Place of publication : New Delhi
2. Periodicity of its publication : Monthly
3. Printer's Name : Ramesh Chopra
   Nationality : Indian
   Address : ELECTRONICS FOR YOU
   D-87/1, Okhla Industrial Area,
   Phase-1, New Delhi 110020
4. Publisher's Name Nationality and address : Same as (3) above
5. Names and addresses of individuals who own the newspaper & partners or shareholders holding more than 1% of the total capital : **EFY Enterprises Pvt Ltd**
   D-87/1, Okhla Industrial Area,
   Phase-1, New Delhi 110020

I, Ramesh Chopra, hereby declare that the particulars given above are true to the best of my knowledge and belief.

Date: 28-2-2023

Ramesh Chopra
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RNI No. 17587/69, Mailed on 1st/2nd of same month
Published on 28th February 2023

Delhi Postal Regd. No.DL(S)-01/3097/2021-23
Licenced to Post without Pre-Payment Licence No.U(SE)-08/2021-23
Posted at LPC Delhi RMS Delhi 110006

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